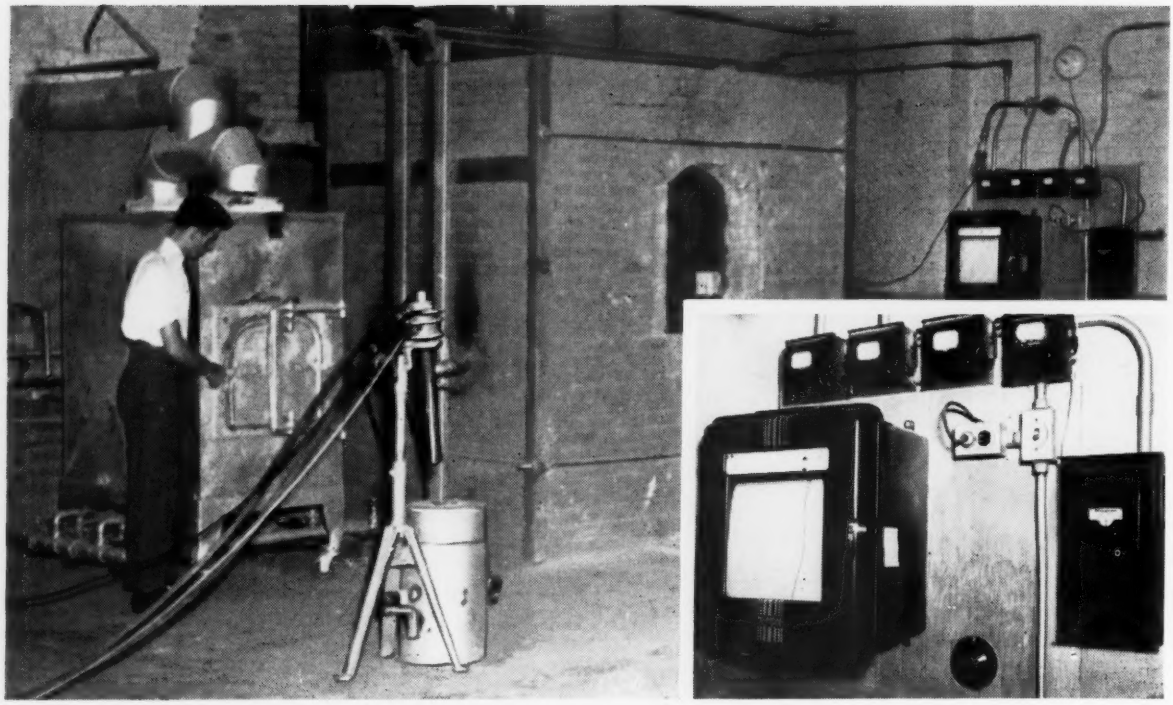
CERAMIC ABSTRACTS and THE BULLETIN

OF THE

AMERICAN CERAMIC SOCIETY

AUGUST 15, 1944

MONTHLY PUBLICATION DEVOTED TO THE ARTS AND SCIENCES RELATED TO THE SILICATE INDUSTRIES



A corner of the laboratory of the Ceramic Engineering Dept., North Carolina State College, Raleigh, N. C. Insert shows their Micromax Pyrometer for either thermocouple or Rayotube.

Effective Use of Micromax Pyrometers In This Ceramic Engineering Lab.

The laboratory shown above has an extremely efficient and economical set-up for measuring the temperatures of its kilns and furnaces, because either a thermocouple or a Rayotube can be switched instantly to the Micromax Pyrometer shown at the right. The Micromax has two ranges; one of 0–3000 F. for thermocouples, and one of 1400–3000 F. for Rayotubes. Both thermocouple and Rayotube are permanently wired to the pyrometer, and either can be connected by simply throwing the switch. This arrangement is widely applicable in engineering.

A typical Rayotube use is in the small cylindrical furnace, where the pyrometric-cone equivalents of refractory materials are determined by ASTM Std. C 24–42. This test requires the material to be heated at consecutively changed rates. Thermocouples have too much lag for this service, and an optical pyrometer has too much "human equation." But the Rayotube, with neither lag nor human equation, solved the problem. In the words of Prof. R. L. Stone, "We follow the ASTM schedule perfectly. It's hard to realize that we used to get along without Rayotubes. Students do better work with them, and Rayotubes also give improved results in industrial consulting."

For a description of Micromax Pyrometers, thermocouples and Rayotubes, consult Catalog N-33A on thermocouples, or N-33B on Rayotubes.

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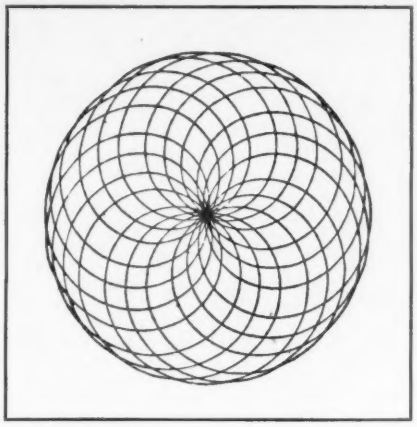
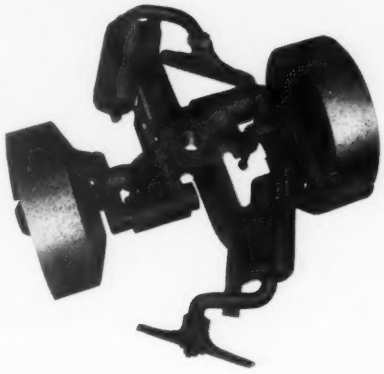


The above diagram clearly illustrates the paths covered by mixing tools during one revolution of the pan.



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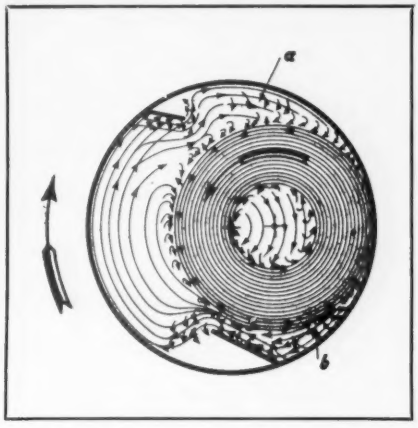
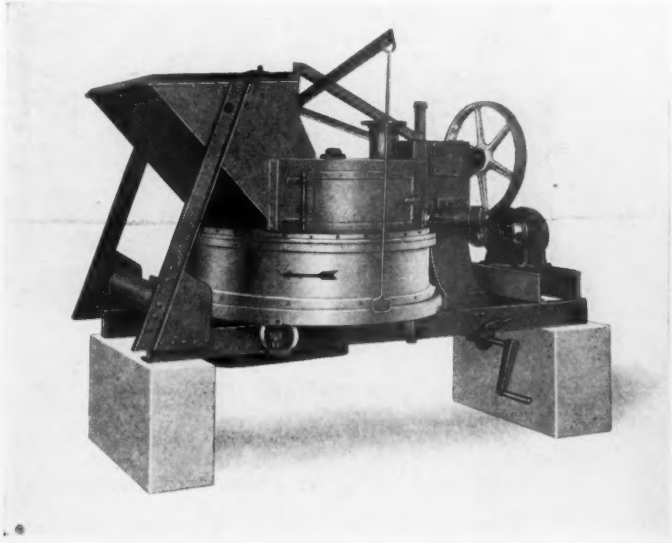


Material conveyed by the pan in clockwise direction at moderate velocity is diverted by a stationary side scraper plow into the narrow trough at "a." It is picked up by the counter-clockwise rotating mixing tool equipment, set off-center of the mixing pan, and rotated around its vertical axis. Material leaving the whirlpool at "b" is picked up by a stationary bottom plow and turned around its horizontal axis, in waves, bringing bottom layers to the top. Countless crossing-over points are created by this ever-changing activity . . . turning, dividing and dispersing without "free fall."



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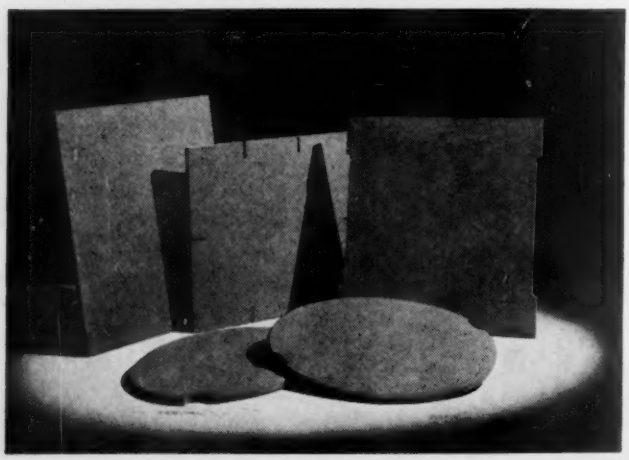

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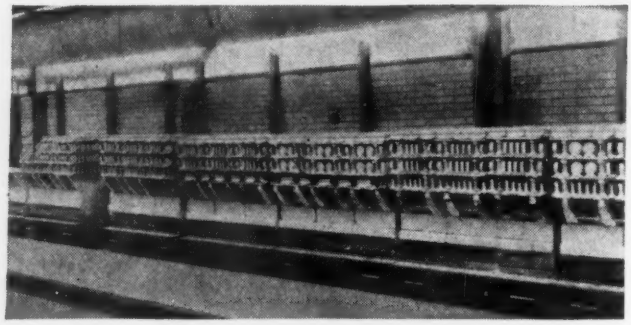

produced an average increase in kiln production of 200% in the electrical porcelain field and 60% in chinaware plants.

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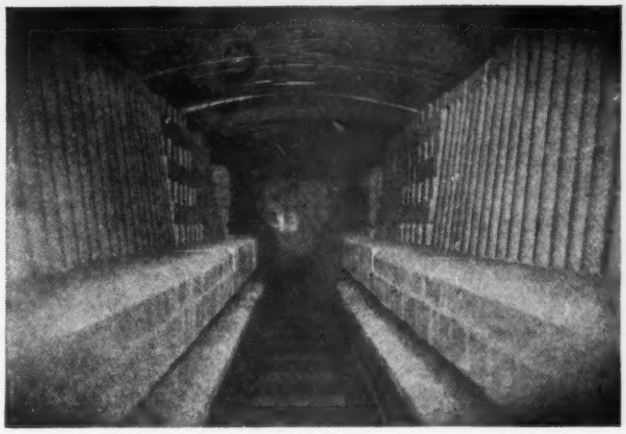

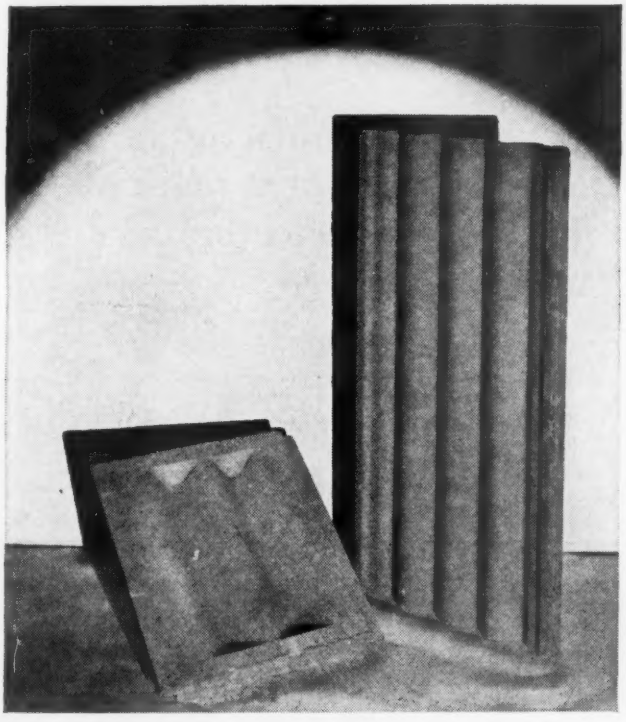

ALUNDUM muffle plates by Norton have been found ideally suited for long service in enameling furnaces because of the high refractoriness, great strength and chemical inertness of this material. And improved design of the refractory shapes has resulted in greater economy to operators of enameling furnaces.

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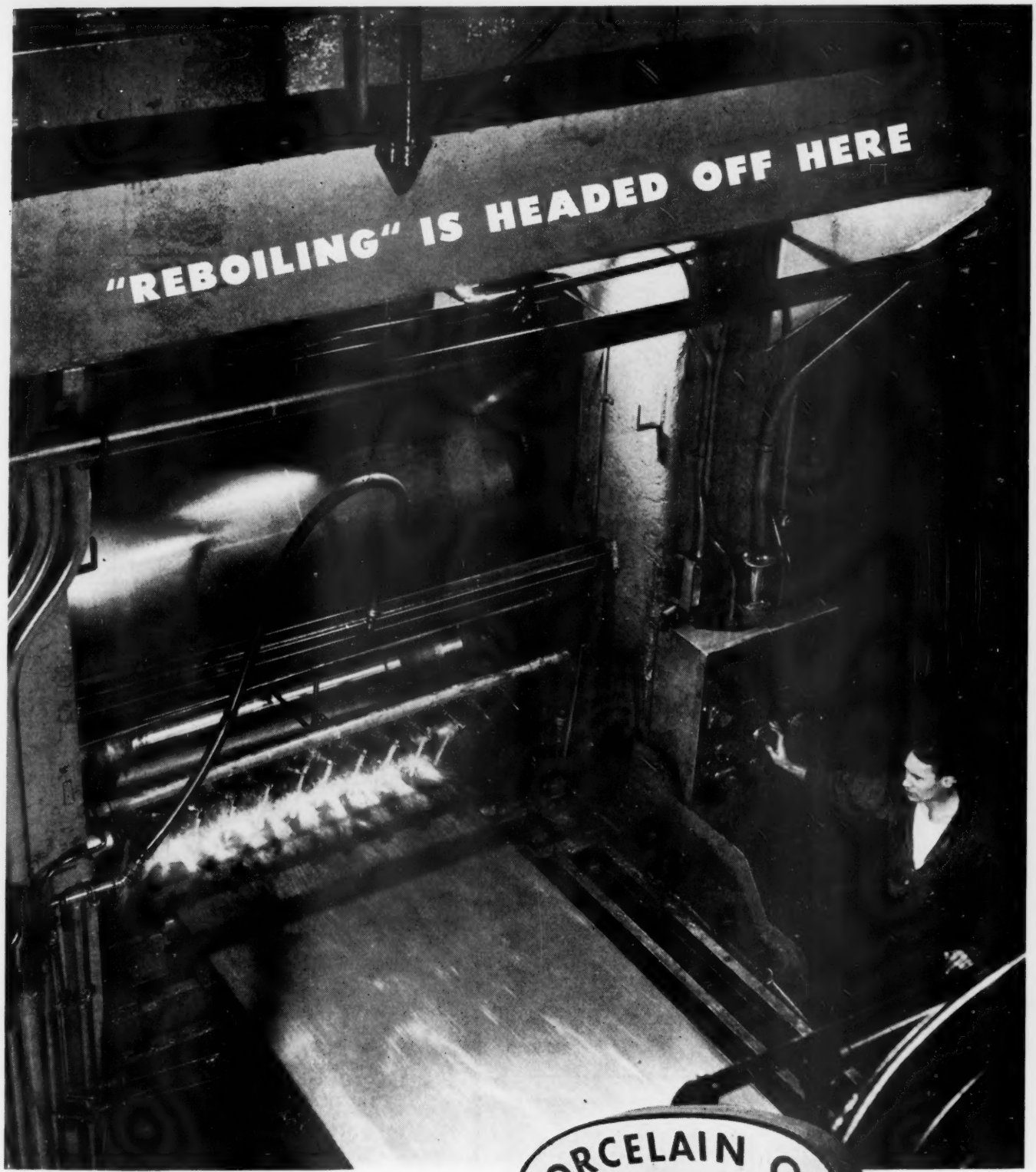

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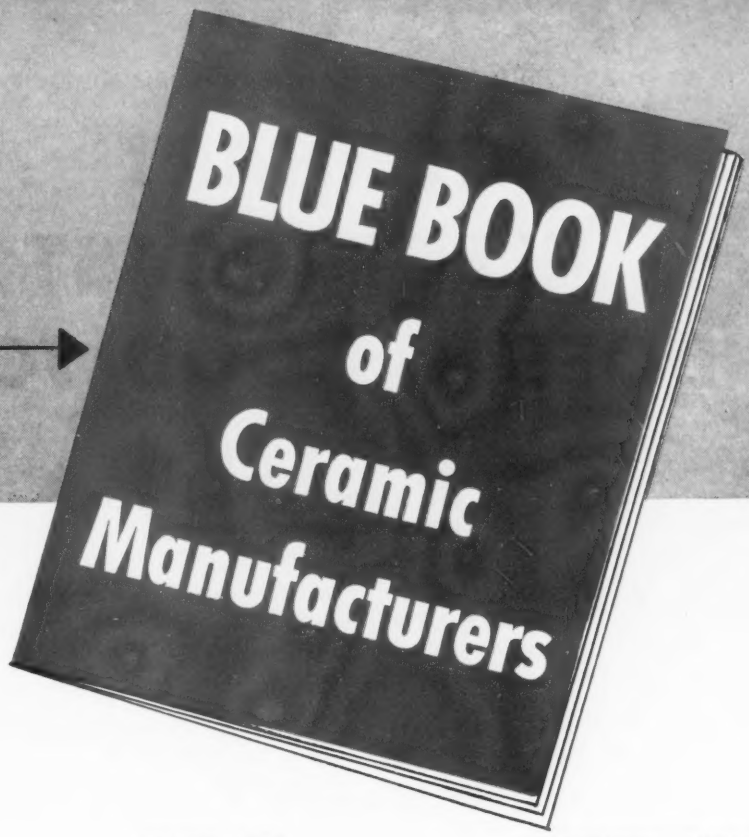

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CORHART* ELECTROCAST DOES A GOOD JOB— PLUS!

ON July 3, 1941, one of our customers started operation of a new Corhart balanced tank, melting flint bottle glass. After 860 days and 62,559.19 tons, the tank was shut down (on Nov. 11, 1943) for a 13-day partial repair.

At the time of this shutdown, the tank had produced 142.18 tons of glass per square foot, which in itself is a good record.

After the tank had cooled, however, careful inspection showed that the Corhart sidewalls and throat could be left intact for another campaign by overcoating at the metal line and making repairs to the superstructure. These repairs were made and the tank was started up again Nov. 25, 1943.

The operating data for the whole of the first period and for the second period up through May 31, 1944, is as follows:

Melting Area 440 Sq. Ft.	Total Days Life	Total Operating Days	Idle Days	Total Tons Flint Glass	Tons of Glass Per Sq. Ft. Per Life
7/3/41 to 11/11/43	860	844	16	62559.19	142.18
Down Period			13		
11/24/43 to 5/31/44 (Still Operating)	189	186	3	15613.58	35.48
TOTAL	1049	1030	32	78172.77	177.66

We will report to you, later, as to the outcome of this complete two-run campaign. As things appear now, we will be unable to give complete details until sometime in the first half of 1945.

Corhart Refractories Company, *Incorporated,* Sixteenth and Lee Streets, Louisville 10, Kentucky.

*Not a product, but a registered trade-mark.

QUALITY ECONOMY ENDURANCE

CORHART ELECTROCAST REFRACTORIES

Ceramic Abstracts Section

Compiled by

THE AMERICAN CERAMIC SOCIETY

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PERIODICAL REFERENCE: The name of the periodical appears in italics, followed by the volume (bold-faced), issue number (in brackets), page numbers, and year (in parentheses).

Vol. 23 **August 15, 1944** **No. 8**

Abrasives

Control of polishing alumina. R. H. POWELL. *Chem. Age* [London], **50** [1295] 378 (1944).—By the exercise of the utmost care in manufacture, under laboratory conditions of thermostatic control and air conditioning, uniform batches of polishing alumina can be prepared if three factors are borne in mind: the hardness, the grain shape, and the particle size analysis of the finished product. The hardness is controlled by the calcination temperature, which is precisely regulated. It affects the rapidity with which a specimen can be polished, for the edges of a suitably hard polishing material do not easily become blunted. Grains which have become dulled may give a high apparent surface polish akin to burnishing, which should be avoided. The grain shape is a factor of importance. Scratching troubles have not been uncommon when alumina has been employed; these are frequently due to the presence of acicular (needle-shaped) particles. It is evident that such a particle can (depending on its orientation on the polishing disk) plough a deep furrow, a broad shallow track, or a narrow shallow track. The particles should approximate as nearly as possible to a regular polyhedral shape. Where alumina is not graded with exceptional care, the inclusion of particles much larger than the average will always produce scratching. The proportions of particles of various sizes should be controlled to produce the optimum mixture for rapid work. If these proportions are so chosen that the interstices between the closest packing of the larger particles are filled up by smaller particles, the surface density of the alumina on the polishing disk will be a maximum. There are three grades of polishing alumina: $^{5}/_{20}$ fast, $^{4}/_{35}$ medium, and $^{3}/_{50}$ slow. The first figure indicates the diameter in microns of the maximum particle size present. The second figure indicates the percentage of material finer than one micron. This new alumina is available in an aqueous suspension needing only dilution with distilled water before use.

A.B.S.

Crystal structure of boron carbide. H. K. CLARK AND J. L. HOARD. *Jour. Amer. Chem. Soc.*, **65** [11] 2115–19 (1943).—The authors have confirmed, by Harker-Patterson and Fourier methods, the interesting structure proposed by Zhdanov and Sevast'yanov for boron carbide. Illustrated.

F.G.H.

Polishing aluminum castings. C. C. DOWNIE. *Machinist*, **84** [37] 369–70E (Nov. 2, 1940); abstracted in *Bull. Brit. Non-Ferrous Metals Research Assn.*, No. 138, p. 331 (Dec., 1940).—D. presents notes on polishing and buffing operations, wheels, abrasives, etc. The fine particles of metal rubbed from the surfaces can be reclaimed and used in Al-paint manufacture.

Problems on quenched steels: I, Cracks of quenched steels; II, Temper cracks of quenched high-speed steels. K. MONMA. *Science Repts. Tôhoku Imp. Univ.*, **28**, 128–42 (Oct., 1939); abstracted in *Jour. Iron & Steel Inst.* [London], **141** [1] 290A (1940).—In Part I M. reports on an investigation of the causes of cracks which appear on the surface of a quenched high-carbon steel on grinding. He found that such cracks are caused by the shrinkage of the thin surface layer of the specimen due to the transformation from α- to β-martensite as a result of the heat generated by the grinding process. The formation of such cracks can be prevented by tempering the quenched specimen at about 150°C. so that it will have a β-martensitic structure throughout before grinding. In Part II he examines the causes of the cracks which appear in tempered high-speed steel of the approximate composition tungsten 20, chromium 5, and cobalt 7%. These cracks are induced by the tensile stress in the decarburized zone set up by the transformation to martensite of the retained austenite of the inner portion. The formation of cracks can be avoided if the decarburized surface layer is ground off before the tempering operation.

PATENTS

Abrading wheel. L. E. THOMPSON. U. S. 2,351,561, June 13, 1944 (Oct. 14, 1942).

Abrasive device for cleaning still tubes, etc. H. G. WEINLAND (Norton Co.). U. S. 2,351,169, June 13, 1944 (April 16, 1941). U. S. 2,351,170, June 13, 1944 (Oct. 18, 1941).

Anchor stud for abrasive wheels. RUDOLPH JOCKEL (Titan Abrasive Co.). U. S. 2,351,129, June 13, 1944 (Jan. 9, 1943).

Apparatus for generating precision cylindrical surfaces. BAUSCH & LOMB OPTICAL CO. Brit. 560,651, April 26, 1944 (June 4, 1942).

Cam-grinding apparatus. C. J. GREEN (Norton Co.). U. S. 2,351,502, June 13, 1944 (Sept. 2, 1942).

Dressing mechanism for grinding wheels. GILBERT STEWART (Ex-Cell-O Corp.). U. S. 2,351,159, June 13, 1944 (Oct. 17, 1941). I. J. SNADER (Ex-Cell-O Corp.). U. S. 2,352,661, July 4, 1944 (Aug. 3, 1940); divided out of U. S. 2,251,961, Aug. 12, 1941 (Dec. 2, 1937). U. S. 2,352,662, July 4, 1944 (Dec. 2, 1937; Aug. 3, 1940; July 28, 1941).

Gear-grinding machine. P. F. SEIBOLD (Michigan Tool Co.). U. S. 2,351,842, June 20, 1944 (April 19, 1940).

Grinding machine. BRYANT CHUCKING GRINDER CO. Brit. 560,809, May 3, 1944 (Nov. 9, 1940). Brit. 560,979, May 10, 1944 (Nov. 9, 1940); divided out of Brit. 560,809. EDWARD SCHOTTLAND (one-half to Robert Schottland). U. S. 2,351,881, June 20, 1944 (Jan. 28, 1943).

Grinding and polishing machine. JOSEF DESENBERG (W. F. and John Barnes Co.). U. S. 2,352,146, June 20, 1944 (April 22, 1939).

Grinding tool for reseating gate valves. J. C. HENDRICK. U. S. 2,351,124, June 13, 1944 (May 22, 1943).

Grinding-wheel dresser. H. W. KROPF AND A. J. BRICKNER (Brickner-Kropf Machine Co.). U. S. 2,351,-269, June 13, 1944 (Sept. 28, 1942).

Keyway grinding tool. W. P. DETTLOFF. U. S. 2,352,-888, July 4, 1944 (Feb. 9, 1944).

Lapping machine. F. J. KENT (Sipp-Eastwood Corp.). U. S. 2,352,105, June 20, 1944 (Jan. 28, 1943).

Machines for grinding screw threads. T. METCALFE. Brit. 560,704, April 26, 1944 (Nov. 19, 1942). Brit. 561,-132, May 17, 1944 (Dec. 21, 1942).

Machine for grinding "V" jewels. MEYER KOULISH (Meyer Koulish Co., Inc.). U. S. 2,351,134, June 13, 1944 (Jan. 8, 1943).

Making abrasive articles. R. C. BENNER AND W. G. SOLEY (Carborundum Co.). U. S. 2,352,246, June 27, 1944 (Nov. 7, 1941).—The method of forming metal-bonded abrasive bodies which comprises preparing a mixture of metal powder and abrasive grit, compressing the mixture to the desired shape, and submerging the compressed shape in a molten salt bath to heat and sinter the metal powder, thereby to form a cemented metal matrix containing the abrasive grit.

Manufacture of pieces which are shaped by grinding. DE HAVILLAND AIRCRAFT CO., LTD., F. B. HALFORD, J. L. P. BRODIE, AND R. MILLER. Brit. 560,606, April 26, 1944 (Oct. 6, 1942).

Method of and mechanism for grinding. BRYANT CHUCKING GRINDER CO. Brit. 560,927, May 10, 1944 (Aug. 13, 1940).

Swing-frame grinding or abrading or like machines. VISCO ENGINEERING CO., LTD., AND H. R. HUTCHINGS. Brit. 561,280, May 24, 1944 (Nov. 17, 1942).

Vitrified grinding wheel. G. N. JEPPSON AND M. F. BEECHER (Norton Co.). U. S. 2,351,433, June 13, 1944 (May 5, 1942).—A vitrified grinding wheel having a relatively large central hole and correspondingly a relatively low ratio of external radius to internal radius, the wheel being characterized by structural features for substantially compensating for diminished resistance, due to its relatively large internal radius, to the stresses of centrifugal force and for opposing the otherwise additive weakening effect due to heat differential, the features comprising an outer grinding zone of bonded abrasive grain and an inner zone of bonded abrasive grain of smaller grit size than the first-mentioned grain and of greater volume percentage of bond than that of the outer grinding zone, there being a series of slots extending inwardly by an appreciable distance from the periphery of the outer grinding zone for permitting expansion of the outer zone and thereby preventing the superimposition of cracking strains upon the inner zone, the smaller grit size and greater volume percentage of bond of the inner zone giving the wheel sufficient strength to resist the stresses caused by centrifugal force and to compensate for the weakening effect of the slots.

Art and Archeology

Designer and technologist share common interest. VINCENT BROOMHALL. *Bull. Amer. Ceram. Soc.*, **23** [7] 222–23 (1944).

Excavation of Han tombs. MENG-CHANG LING. *Bull. Amer. Ceram. Soc.*, **23** [7] 245–49 (1944).—2 figures.

Specification of color. R. A. SCHOFIELD. Abstracted in *Chem. & Ind.*, **58** [52] 1118–19 (1939).—S. discusses four general methods for obtaining the C.I.E. specification of a color: (1) from the spectral reflection or transmission curve, (2) by photoelectric measurement, (3) by visual matching of additive mixture, and (4) by visual matching by subtractive mixture.

George F. Young: a story of Roseville Pottery. ANON. *Bull. Amer. Ceram. Soc.*, **23** [7] 220–22 (1944).—5 photographs.

Cements

Effect of deflocculents on physical properties of pottery plaster molds. L. E. CUNNINGHAM AND E. W. DUFFY. *Bull. Amer. Ceram. Soc.*, **23** [7] 249–54 (1944).—1 reference, 4 figures.

Investigations of the binding properties of the calcium aluminate and silicate type of chemical compounds. V. F. ZHURAVLEV. *Tsement*, **1939**, No. 8, pp. 41–42; *Khim. Referat. Zhur.*, **1939**, No. 12, p. 78; *Chem. Abs.*, **35**, 595 (1941).—Z. investigated the systems $ZnO–Al_2O_3$, $ZnO–SiO_2$, $SrO–SiO_2$, $SrO–Al_2O_3$, $CdO–SiO_2$, $BaO–SiO_2$, and $BaO–Al_2O_3$ and synthesized the following types of aluminates and silicates of Ca possessing binding properties: $2SrO·SiO_2$, $SrO·Al_2O_3$, $3SrO·Al_2O_3$, $SrO·2Al_2O_3$, $2BaO·SiO_2$, $BaO·Al_2O_3$, and $3BaO·Al_2O_3$. $ZnO·Al_2O_3$, $2ZnO·SiO_2$, $SrO·SiO_2$, $2CdO·SiO_2$, and $BaO·SiO_2$ do not have binding properties. See "Regularity. . .," *Ceram. Abs.*, **22** [3] 62 (1943).

New lime–zinc oxide cements. V. F. ZHURAVLEV AND M. M. GORDON. *Tsement*, **1939**, No. 8, p. 42; *Khim. Referat. Zhur.*, **1939**, No. 12, p. 78; *Chem. Abs.*, **35**, 595 (1941).—Cements containing ZnO in amounts of 2 to 62 were white, resistant to air and water, and of considerable mechanical strength.

Research in lime reviewed as NLA group meets in Virginia. ANON. *Pit & Quarry*, **36** [12] 74, 76–77 (1944).—The National Lime Assn. held an open board meeting, in place of its annual convention, at Hot Springs, Va., May 16 to 18. Postwar problems as they affect the lime industry and research work, present and future, were the principal topics. M.R.

Enamel

Ceramic engineer in porcelain enameling plants. C. S. PEARCE. *Bull. Amer. Ceram. Soc.*, **23** [7] 227–29 (1944).—An editorial.

Layout of a modern continuous strip-pickling plant. ANON. *Sheet Metal Ind.*, **13**, 994–96 (Aug., 1939); abstracted in *Jour. Iron & Steel Inst.* [London], **141** [1] 28A (1940).—The continuous pickling plant recently completed at the Cardiff works of Guest, Keen & Nettlefolds, Ltd., is described and illustrated.

Vermiculite in enameling. ANON. *S. African Mining*

& Eng. Jour., **54,** Pt. II [2650] 231 (1943); *Bull. Imperial Inst.*, **42** [1] 54–55 (1944); *Chem. Age* [London], **50** [1292] 310–11 (1944).—A process producing on vitreous porcelain enameled articles a finish resembling that of gold, brass, copper, or bronze (South Africa Patent 928, March 28, 1943) comprises introducing crude vermiculite into a furnace at a temperature above 1650°F., cooling, crushing, passing the cooled material through a sieve or sieves to remove the dust, and applying the crushed and sieved vermiculite to the surface of the article. The treatment decomposes the vermiculite with loss of combined water and forms honeycombed granules which are extremely brittle when hot. The material is passed through sieves to remove the dust, air under a pressure of 60 lb. per sq. in. being used. The product has the appearance of gold dust. The enameled articles are prepared in the usual commercial manner. To obtain the metallic appearance, the powdered vermiculite is mixed with enamel according to the color desired, e.g., for brass, yellow enamel, and for bronze, bronze-brown. The article, which has been sprayed with vitreous or porcelain enamel, is resprayed with the vermiculite enamel while still wet and then dried in the usual way. The surface of the dried enamel is then lightly rubbed with the fingers or a soft pad, just enough to expose the granulated vermiculite, and fired. After firing, the surface is lightly rubbed over with fine emery paper or other abrasive material to remove any loose particles of vermiculite. An alternative method is to dust the dry powdered vermiculite onto the last application of porcelain enamel while still wet.

G.A.K. & A.B.S.

PATENTS

Enamel. A. J. DEYRUP (E. I. du Pont de Nemours & Co.). U. S. 2,351,252, June 13, 1944 (Aug. 9, 1943).—A vitreous enamel composition suitable for use in enameling electrical resistors which comprises lead oxide in amounts ranging from 45 to 65, silica 4 to 15, boric oxide 4 to 20, alumina 3 to 9, and ferric oxide 9 to 20%, the percentages being by weight based on the total weight of the vitreous enamel.

Preparing fritted foundations for the enameling of metallic articles. KARL FRANK (vested in the Alien Property Custodian). U. S. 2,351,811, June 20, 1944 (April 19, 1938).—The process of preparing a metal article to receive a fused enamel coating which consists in first applying a porous waterproof and acidproof fritted foundation to the surface of the article and thereafter galvanically depositing a bonding metal upon the metal surface through the pores of the fritted foundation.

Glass

Ceramic glass connection sealing *in vacuo*. H. VATTER. *Feinmech. & Präzision*, **51,** 181–86 (1943).—The strength of ceramic bodies depends to a high degree on the kind of glazing, course of stress in the connection, selection of glasses, methods of testing the best adaptation, methods of production by hand and by machine, cooling, and glass-ceramic-metal connections. P.G.

Electrically heated tacking oven used in the manufacture of safety glass. R. A. SCHOENFELD. *Ind. Heating*, **11** [6] 950–56 (1944).—The manufacture (by the Guardian Glass Co., Detroit, Mich.) of safety glass consisting of two sheets of glass with a sheet of vinyl resin between them is described. An electrically heated oven 4 ft. wide and 24 ft. long is used to heat the glass up to 550°F.; this temperature is held by close control. Lamination is accomplished in an oil bath at 250°F. in an autoclave in which the air is exhausted and the pressure is brought up to 225 lb. per sq. in. A pressure water spray cleans the finished glass from oil. M.HA.

Glass fiber spinning: I. I. SAWAI AND M. MINE. *Jour. Soc. Chem. Ind. Japan*, **43** [10] 351–52B (1940); *Brit. Chem. & Phys. Abs.–B*, **1941,** May, I, 176.—Sintered corundum may be used instead of Pt as a material for nozzles in spinning glass fibers by the drum method. Drawing the fibers more rapidly diminishes their diameter but leaves the amount of glass drawn out unchanged. See "Laboratory. . .," *Ceram. Abs.*, **21** [7] 141 (1942).

Introduction to the practice of the foundry laboratory. A. NAGEL. *Giessereipraxis*, **63** [17] 210–12; [18] 222–24 (1942).—Detailed instructions for making apparatus of glass, quartz, and porcelain are given, and the different types of glass to be used for various purposes and in connection with rubber and metal parts, such as Pt, Ni, etc., are described at length. M.HA.

Mineral wool. M. S. KRISHNAN. *Trans. Mining, Geol. & Met. Inst. India*, **35,** 401–28 (Feb., 1940); abstracted in *Jour. Iron & Steel Inst.* [London], **142** [2] 47A (1940).—K. discusses the prospects of the manufacture of glass wool, slag wool, and rock wool in India as by-products of the Portland cement industry and of the iron and steel industry. There is a large potential market for such material in India because it is a tropical country where the insulation of structures against heat has scarcely begun.

New types of optical glass. W. M. HAMPTON, R. E. BASTICK, AND W. N. WHEAT. *Nature*, **153** [3879] 283 (1944).—The authors summarize the present position in new optical glasses and indicate probable lines of development. New glasses contain appreciable quantities of silica and boric acid as the network formers, and their exceptional properties depend on the addition of the oxides of barium, lead, zinc, and certain other metals. Their optical properties lie between the limits of V value of 60 and 40, and their refractive indices are greater than (1.860 to 0.004 V). W. G. BENT. *Ibid.*, [3888] 559.—The full range of optical properties in glasses obtained by the Eastman Kodak Co. from the use of rare elements with little or no proportion of silica is given graphically.

G.A.K.

***Viscosity of glasses of the system $Na_2Si_2O_5$–$PbSiO_3$ in the softening range.** B. A. POSPELOV AND K. S. EVSTROP'EV. *Zhur. Fiz. Khim.*, **15,** 125–33 (1941); abstracted in *Physik. Ber.*, **23** [18] 1697 (1942).—The glasses of this system show, in the interval of 10^6 to 10^{15} poises, that the viscosity in the range 400° to 1400°C. can be sufficiently exactly expressed by Waterton's equation, while that of Fulcher and Tammann holds good only in a narrow temperature range. The temperature dependence can be expressed by $\log \eta = A + (\alpha/T^2)$. The formula can be applied in the viscosity range from 10^{-1} to 10^4 and from 10^4 to 10^{15} poises. The change of $\log \eta$ for this system in the range up to 700°C. can be expressed by $\log \eta = a + bc$, where a and b are constants and c is the mole % of $PbSiO_3$ or $Na_2Si_2O_5$. For temperatures of 550° to 600° $\log \eta$ is represented by a function of two straight lines intersecting at a point corresponding to the composition $Na_2Si_2O_5 \cdot 2PbSiO_3$. M.HA.

PATENTS

Apparatus for and method of forming glassware. BRITISH HARTFORD-FAIRMONT SYNDICATE, LTD. Brit. 560,576, April 26, 1944 (Oct. 4, 1941). Brit. 560,672, April 26, 1944 (Sept. 13, 1941).

Apparatus for producing a ground or ground and polished continuous strip of glass. PILKINGTON BROS., LTD., AND F. B. WALDRON. Brit. 561,112, May 17, 1944 (Oct. 31, 1942).

Apparatus for sealing containers. W. D. BELL (Anchor Hocking Glass Corp.). U. S. 2,352,761 and 2,352,762, July 4, 1944 (April 8, 1939). U. S. 2,352,763, July 4, 1944 (Jan. 17, 1940).

Apparatus for sealing glass envelopes. BRITISH THOMSON-HOUSTON CO., LTD. Brit. 560,622, April 26, 1944 (March 13, 1942).

Apparatus for treating surfaces. HAROLD OSTERBERG, G. E. PRIDE, AND R. K. LUNEBURG (Spencer Lens Co.). U. S. 2,351,537, June 13, 1944 (March 5, 1942).

* Obtained from microfilm.

Cap-feeding apparatus. W. D. Bell (Anchor Hocking Glass Corp.). U. S. 2,352,764, July 4, 1944 (Jan. 17, 1940; May 19, 1941).

Electron lens structure. Frank Gray (Bell Telephone Laboratories, Inc.). U. S. 2,351,501, June 13, 1944 (May 31, 1941).

Forming glass articles. R. W. Kell (Corning Glass Works). U. S. 2,352,957, July 4, 1944 (March 6, 1942).

Forming optical prisms. George Kende, Eli Elison, and Sten Johanson (Universal Camera Corp.). U. S. 2,352,551, June 27, 1944 (March 2, 1942).

Glass feeder. J. W. Ross (Hazel-Atlas Glass Co.). U. S. 2,352,288, June 27, 1944 (Nov. 27, 1941).

Glass furnace. A. L. Pasquier (Franklin Glass Corp.). U. S. 2,352,860, July 4, 1944 (Nov. 27, 1939).

Insulator. M. K. Holmes (Owens-Illinois Glass Co.). U. S. 2,352,151, June 20, 1944 (July 12, 1941).

Lehr. C. E. Hahn (General Electric Co.). U. S. 2,351,262, June 13, 1944 (Feb. 10, 1941).—A lehr for heat-treating vitreous tubes.

Lens-centering device. Jacques Bolsey. U. S. 2,352,179, June 27, 1944 (Jan. 5, 1943).

Luminaire. T. W. Rolph (Holophane Co., Inc.). U. S. 2,352,801, July 4, 1944 (Aug. 7, 1943).

Machine for the treatment of lenses. Jacques Bolsey. U. S. 2,352,180, June 27, 1944 (Jan. 29, 1943).

Making hermetic glass-to-metal seals. Marconi's Wireless Telegraph Co., Ltd. Brit. 560,717, May 3, 1944 (Oct. 8, 1941).

Method of and apparatus for drawing sheet glass. H. L. Halbach, G. D. Campbell, and W. G. Koupal (Pittsburgh Plate Glass Co.). U. S. 2,352,539, June 27, 1944 (Dec. 1, 1939).

Mineral wool treating material. W. M. Bergin and A. L. Simison (Owens-Corning Fiberglas Corp.). U. S. 2,351,802, June 20, 1944 (Oct. 11, 1940).

Reduction in reflection from glass. G. L. Dimmick (Radio Corp. of America). U. S. 2,352,085, June 20, 1944 (Aug. 29, 1941).—An optical element having a refracting surface and a reflection-reducing coating thereon having a thickness of approximately one-quarter wave length of the light for which maximum reflection reduction is to be produced and consisting of evaporated and deposited gearksutite, $CaF_2 \cdot Al(F,OH)_3H_2O$.

Sealing-in and molding lamp bulbs. M. E. McGowan (Westinghouse Electric & Mfg. Co.). U. S. 2,351,530, June 13, 1944 (July 13, 1940); divided out of U. S. 2,212,842, Aug. 27, 1940 (Dec. 21, 1935).

Support for lens blanks and process of securing lens blanks to supports. Jacques Bolsey. U. S. 2,352,178, June 27, 1944 (Jan. 5, 1943).

Traversing apparatus. Ed Fletcher and E. J. Fisher (Owens-Corning Fiberglas Corp.). U. S. 2,352,781, July 4, 1944 (Jan. 1, 1943).—Apparatus for packaging material in strand form.

Treating surfaces. Harold Osterberg, G. E. Pride, and R. K. Luneburg (Spencer Lens Co.). U. S. 2,351,536, June 13, 1944 (April 25, 1941).—The method of forming a coating on a surface of an article comprising rotatably mounting the article in an evacuated chamber relative to the source of coating material and spaced therefrom, with the surface to be coated being substantially entirely exposed toward the source of coating material, causing emission of the coating material from the source, and rotating the article about an axis which is inclined with relation to a vertical line passing through the source of coating material, with the inclination being controlled according to the formula

$$J = \frac{(1 + (r^2/d^2)\cos 2\delta)}{(1 + (r^2/d^2) + 2(r^2/d^4)\cos 2\delta)^{3/2}}$$

where J is the ratio of thickness of deposit at zone r, r is the distance from the center of the article to an arbitrary point thereon, d is the distance from the source to the center of the article, and δ is the angle between the vertical line passing through the source and the axis of the article, to give a coating of controlled thickness on the article with the angle δ being varied according to the resultant characteristics required of the surface coating and according to the shape of the surface being coated.

Structural Clay Products

Flemish-Belgian brick industry. E. Hildebrandt. *Tonind.-Ztg.*, **65,** 368 (1941); abstracted in *Trans. Brit. Ceram. Soc.*, **41** [2] 22A (1942).—The Belgian brick industry has an output of 200 million brick per year. The type of equipment used, ranging from the local hand-molding machine to high-capacity extrusion presses, is described. Different kinds of raw material are used, depending on the local method of preparation and manufacture. The situation of the brick plants between Rupel and Nethe and the northwest Belgium district is described, and the method of transport is discussed. The clay deposits are described, and the method of winning with the most modern equipment is detailed. The method of treating the clay is given, and the economy is stressed.

Internal operational training for brickworks' foremen. H. G. Schmidt. *Tonind.-Ztg.*, **65,** 395 (1941); abstracted in *Trans. Brit. Ceram. Soc.*, **41** [1] 13A (1942).—In any organized course of training in works' methods and technology, the following points should be studied: The foremen who attend should be instructed in the problems which arise in a brickworks from day to day. Works' practice should be based on the fundamental technical sciences, e.g., natural science, economics, organization, and psychology. Future foremen should be selected on the basis of their interest in the technical aspect of their work. A suggested curriculum is given.

Postwar-housing relationship to industry. Irving W. Clark. *Bull. Amer. Ceram. Soc.*, **23** [7] 239–43 (1944).

Urges widespread adoption of new masonry code. Anon. *Pit & Quarry*, **36** [12] 105 (1944).—The Producers Council is urging the adoption of a masonry code (as a standard) which was sponsored by the National Bureau of Standards and approved by the American Standards Assn. The National Concrete Masonry Assn., National Lime Assn., Portland Cement Assn., and the Structural Clay Products Institute are directly interested. M.R.

PATENTS

Ceramic bubble cap. W. E. Harris. U. S. 2,351,855, June 20, 1944 (Nov. 10, 1942).

Refractories

Basic Refractories' crushers located in pit 65 feet below quarry floor level. W. E. Trauffer. *Pit & Quarry*, **36** [12] 62–65, 72 (1944).—T. discusses the formation of Basic Refractories, Inc., and describes its Maple Grove, Ohio, plant. In this plant the company processes 400 to 450 tons per hour of flux stone, refractory stone, aggregates, agstone, etc. 11 photographs, 1 diagram. M.R.

Bauxite and magnesite production in Yugoslavia. Anon. *Chem. Age* [London], **50** [1297] 430 (1944).—Yugoslavia is one of the richest sources of bauxite in the world, but only a small part of it has been exploited. The most important deposits are on the Adriatic Coast, including the islands Krk, Rab, and Pag. At present only seven of the mines are under exploitation. The material

contains an average of 53 to 55% alumina with only 1 to 2% silica. At Lozovak near Sibenik, an aluminum factory has been established; exports amount to more than 500,000 tons per annum. Magnesite is one of the youngest branches of the Yugoslavian mining industry, yet it ranks fourth in Europe. The magnesite is of excellent quality and has an average content of 92 to 96% $MgCO_3$ with only 1 to 2 SiO_2, 0.5 CaO, and 1 to 2% Fe_2O_3 + Al_2O_3. Exported material, partly lump and partly ground or sintered, is over 50,000 tons yearly.

A.B.S.

Calcined mullite refractory. I. I. KITAĬGORODSKIĬ AND T. N. KESHISHYAN. *Compt. Rend. Acad. Sci. U.R.S.S.*, **23,** 152–54 (1939); *Brit. Chem. & Phys. Abs.–B,* **58** [10] 1038 (1939).—A mixture of Al_2O_3 72, SiO_2 25, and pure MgO 3% was calcined at 1500° for 6 hr. and then at 1700° for 30 min. The product was a highly resistant refractory, negligibly attacked by molten glass at 1300°.

Crucibles need care. FRED L. WOLF. *Foundry,* **71** [9] 105, 172–73 (1943).—Precautions to be observed in the use of graphite, clay-graphite, and silicon carbide-graphite crucibles are discussed in detail. F.G.H.

Experiences with ribbed arches on large electric-arc furnaces. P. BREMER. *Stahl & Eisen,* **60,** 763–64 (Aug. 29, 1940); abstracted in *Jour. Iron & Steel Inst.* [London], **144** [2] 63A (1941).—B. discusses the factors affecting the life of the roofs of electric-arc furnaces and points out the advantages which have accrued from the use of ribbed arches, especially for large furnaces. The design of a ribbed roof that has given excellent service at the works of the Bochumer Verein is described and illustrated. He suggests that refractory-brick manufacturers should make great efforts to produce a pure magnesite brick with a high thermal-shock resistance, which would be suitable for electric-furnace roofs.

Impact strength of refractory and ceramic materials and its determination. B. YA. PINES AND I. L. ROTENBERG. *Zavodskaya Lab.,* **8** [3] 308–15 (1939); abstracted in *Jour. Iron & Steel Inst.* [London], **140** [2] 252A (1939).—Results of impact tests on a Charpy pendulum machine lead to the conclusion that a straight-line relationship exists between the impact strength of several refractories and the square of the velocity of impact. It is therefore concluded that the values obtained in no way correspond to the impact-strength characteristics of the materials tested, the greater part of the impact energy being used up in supplying kinetic energy to the fragments of the test piece and in setting up vibration in the base of the instrument. Much more reliable figures for the work required to fracture the test piece can be obtained from static bend tests, in which the deflection is measured by an optical method. This is true even in the case of magnesite, which undergoes a small amount of plastic deformation before fracturing.

Insulating refractory in [petroleum] cracking-furnace construction. M. G. VAN VOORHIS. *Nat. Petroleum News,* **31** [10] 82–84R, 86R (1939); *Brit. Chem. & Phys. Abs.–B,* **58** [9] 903 (1939).—Refractories containing minute air bubbles dispersed throughout the mass have a thermal conductivity, weight, and heat capacity one third to one fourth that of ordinary firebrick of similar composition. Various designs of tube-still heater wall in which such refractories are employed are illustrated. The refractory wall is backed with calcined diatomaceous earth or SiO_2 containing asbestos fiber, and the whole is inclosed in a steel sheathing. See "Refractory. . .," *Ceram. Abs.,* **20** [6] 147 (1941).

Mechanism of the formation of silica brick. T. AO. *Jour. Japan. Ceram. Assn.,* **47** [562] 521–25 (1939); abstracted in *Trans. Brit. Ceram. Soc.,* **39** [4] 36A (1940).—A study of the mechanism of the formation of silica brick can be divided into (1) a study of the thermal equilibrium of quartz, the principal mineral component, and (2) a study of the binary and ternary systems of ferric-ferrous oxides and lime, the bonding materials in silica brick. Various kinds of keiseki were heated to 800°C. and cooled at the rate of 3° per min. Though the thermal effects vary with the different kinds of samples, it was confirmed that the α- to β-quartz transition point begins at about 570°. It was also confirmed that silica brick consist of cristobalite with innumerable cracks, which is transformed from α-quartz and amorphous quartz, and that they are surrounded by a mixture of colorless prismatic crystals, calcium ferrite and free iron oxide existing as bonding materials.

Open-hearth bottom construction. A. MORTON. *Blast Furnace & Steel Plant,* **27,** 469–70 (1939); *Brit. Chem. & Phys. Abs.–B,* **59** [3] 209 (1940).—A 3-in. layer of insulation is followed by 12.5 in. of clay brick, a 9-in. soldier course of chrome brick, and a 9-in. soldier course of chrome-magnesite brick. See *Ceram. Abs.,* **19** [7] 164 (1940).

Rapid increase in bauxite production (in Europe). ANON. *Chem. Age* [London], **50** [1292] 317–18 (1944).—Bauxite is the only major nonferrous raw material of which Europe has abundant reserves. Germany has no extensive bauxite deposits, and the German aluminum industry is entirely dependent on imports. By the occupation of central and southeastern Europe, Germany got control of the bauxite deposits in Hungary, Yugoslavia, Greece, Czechoslovakia, and France. Germany tried to establish, prior to the war, emergency production schemes to utilize low-grade clays and phonolites for the production of aluminum. These schemes have been suspended in view of the vast deposits now at the disposal of the Germans. The largest reserves of European bauxite are on Hungarian territory. They have been estimated at well over 250 million tons, and further prospecting, intensified during the last few years, reveals a yet greater tonnage. The neighboring Yugoslav deposits amount to 100 million tons, whereas France (originally the largest European producer of bauxite but now superseded by Hungary) has deposits amounting to only about 60 million tons, equalling those of Greece. According to recent German estimates, the Rumanian deposits can be estimated at about 40 million tons, and the Italian, at 20 million tons. The Bauxite Trust Co. in Zurich, operating mines in Hungary, Croatia, Italy, Czechoslovakia, and Rumania, increased its capital from 11 million to 13.5 million Swiss francs. This company has stated that a further 24 million Hungarian pengö will be required to extend the existing mines, open new deposits, and increase the output of factories producing aluminum products. The company was founded in Hungary in 1917 with only 3 million pengö capital which, after the reorganization of Hungary in 1918, was increased to 6.5 million pengö, and, in 1932, to 30 million pengö. The other Hungarian company, Aluminiumerz Bergbau & Industrie A. G., Budapest, merged with the Bauxite Industrie A. G., Budapest, in 1941, to form the company called Danubian Industry of Aluminium Production, with a capital of 8 million pengö, under the patronage of the Bauxite Trust Company. Its capital was later raised to 35 million pengö, this sum being divided equally between the Hungarian State, the Vereinigte Aluminiumwerke of Berlin, and the Bauxite Trust Co., Zurich. The rapid rise of production of bauxite in Hungary is important; in 1933 it amounted to 66,200 tons; in 1934, 185,000; in 1935, 245,000; in 1936, 368,000; in 1937, 510,000; and in 1938, 521,000. These figures differ somewhat from the American statistics given in the "World's Production of Bauxite," but the increase is of the same order, though it is carried on to 600,000 tons in 1941. The bauxite mine at Gant is the richest in Hungary, not only in quantity but also in quality. The located deposit is estimated at 120 million tons. The Bakonyi deposits require deeper mining. The new locations in the vicinity of Iszkaszentgyorgy and Guttaman are very promising; mining was started in the autumn of 1940, and a new railway branch 7 km. long was constructed. The mines at Bihar Komitat (Siebenburgen), which belonged to the Alumins Societate Anonima Miniera, Bucharest, were transferred to Hungary from Rumania under the Vienna Axis decision, and the Hungarian Industrie A. G. has resumed operations there. The export of the Bauxite Industrie A. G., Budapest, formerly considerable, fell sharply in 1941 and has since almost ceased. The recent increase in capital of the joint concern was spe-

cially earmarked for the construction of a new plant near Ajka, with an annual productive capacity of 20,000 tons of alumina. A.B.S.

Refractories and the electric furnace, with particular reference to the roof. ANON. *Metallurgia*, **19** [111] 97–98 (Jan., 1939); abstracted in *Bull. Brit. Non-Ferrous Metals Research Assn.*, No. 117, p. 54 (Feb., 1939).

Refractories for heat-treatment furnaces. ANON. *Metallurgia*, **20** [May] 35–36, 38 (1939); abstracted in *Jour. Iron & Steel Inst.* [London], **140** [2] 129A (1939).—The properties of some of the improved refractory brick and cements, with special reference to sillimanite and diatomaceous insulating brick, are briefly reviewed.

Refractory materials for reverberatory furnaces. A. B. SEARLE. *Metallurgia*, **21**, 129–31 (Feb., 1940); abstracted in *Jour. Iron & Steel Inst.* [London], **142** [2] 44A (1940).—S. discusses the refractory materials used for a reverberatory furnace, dealing separately with the requirements for the fuel hearth, bridge, metal hearth, nozzles, side walls, roof, and flue. He emphasizes the importance of careful selection of refractory material for each particular part of a furnace to ensure economical service.

Refractory selection and maintenance problems. DAVE W. WUERTHELE. *Paper Trade Jour.*, **116** [19] 48–50 (1943).—The selection of a refractory or several types of refractories is determined by the inherent characteristics of the refractories to meet the operation conditions. The maintenance and selection of refractories for furnace linings and for kilns is discussed with particular regard to the paper industry. W.R.B.

Removal of ferric oxide from high alumina refractory raw materials in North China. S. NAGAI AND K. NAKAJIMA. *Jour. Japan. Ceram. Assn.*, **48** [569] 199–202 (1940); abstracted in *Jour. Soc. Glass Tech.*, **24** [103] 144 (1940).—Ten to 30% Fe_2O_3 in refractory raw materials was eliminated by treating with 20 to 30% solution of HCl or H_2SO_4 on a water bath. Efficiency of elimination was 85 to 95%.

Thermal conductivity of insulating materials. E. A. ALLCUT AND F. G. EWENS. *Can. Jour. Research*, **17A**, 209–15 (1939); *Brit. Chem. & Phys. Abs.–B*, **59** [5] 331 (1940).—The use of the thermal conductivity (k) given by Fourier's formula $Q = kA(dx/dt)$ in comparing the heat-insulating materials employed in building construction is misleading since the hot-plate method of testing gives results which are affected by surface resistance to heat flow, by the structure of the material and its density, by heat-convection currents, and in some cases by radiation effects. These properties are variable. It is suggested that the conductance, which is actually used in calculating k, should be adopted as the property to be measured. See "Heat . . . ," *Ceram. Abs.*, **19** [4] 102 (1940).

Use of drum furnaces in the iron and metal foundry. R. THEWS. *Giessereipraxis*, **63** [14] 175–78 (1942).—Besides the crucible furnace, the drum furnace has found wide application for universal purposes, including the melting and alloying of light and heavy metals. Its greatest advantage is its flexibility in making diversified melts consecutively. The fuel consumption for 100 kg. charge is 18 to 24 m.³ of gas or 8 to 10 kg. of oil for copper and 14 to 20 m.³ of gas or 6 to 8 kg. of oil for tin bronze and red brass. The melting time in minutes is shown in the following table:

Material	150 kg.	500 kg.	1000 kg.	2000 kg.
Copper	40–50	50–60	65–75	100–110
Tin bronze	45–50	55–60	65–70	80– 90
Red brass	35–40	45–50	55–60	70– 80

Aluminum requires 45 to 60 m.³ of gas or 22 to 25 kg. of oil and 25 to 30 min. melting time for 50 kg., 30 to 35 min. for 175 kg., 35 to 40 min. for 350 kg., and 50 to 60 min. for 650 kg. The highest obtainable temperatures in a drum furnace are 1450° to 1650°C. with combustion air preheated to 300°–500°C. by the waste gas. Questions of design, mixture of charges, and melting practice are discussed. M.HA.

Use of insulating concrete in coke-oven doors. H. SHAW. *Gas World* [Coking Sect.], **111**, 95–101 (1939); *Brit. Chem. & Phys. Abs.–B*, **58** [9] 902 (1939).—Concrete made from china clay and Portland cement has a thermal conductivity about one-fourth that of firebrick and lower density. It can be used in either the monolithic or built-up form.

PATENTS

Producing alumina. WALTER DYCKERHOFF AND WILHELM WITTEKINDT (vested in the Alien Property Custodian). U. S. 2,351,941, June 20, 1944 (April 29, 1941).—The process of recovering alumina from aluminous raw materials which comprises mixing the raw materials with an alkaline earth, calcining the mixture, lixiviating one part by weight of the calcined product with alkali metals carbonate solution in the presence of 3 to 6 parts by weight of the calcined product obtained from a former operation, already lixiviated and consisting largely of silica residue, and precipitating alumina from the resulting alkali metal aluminate solution.

Refractory zirconia casting. G. S. FULCHER AND T. E. FIELD (Corhart Refractories Co.). U. S. 2,352,530, June 27, 1944 (Oct. 11, 1939).—A heat-cast refractory for contact with molten glass consisting essentially of zirconia and at least one of the alkalis Li_2O, Na_2O, and K_2O in which the total alkali is less than 15% by weight by chemical analysis and substantially free from alumina.

Silica refractory. F. A. HARVEY AND R. E. BIRCH (Harbison-Walker Refractories Co.). U. S. 2,351,204, June 13, 1944 (Nov. 30, 1940).—A superduty silica refractory brick containing alumina, titania, and alkalis in a total amount not over 0.5%, at least one oxide of the group consisting of oxides of calcium, magnesium, strontium, manganese, zinc, nickel, cobalt, and ferrous iron, the total amount of the oxides of the group exceeding the sum of the alumina, titania, and alkalis by at least 3.3 to 1 but being not over about 5%, and the remainder being substantially all silica.

Terra Cotta

Diffusion of water vapor through various building materials. J. D. BABBITT. *Can. Jour. Research*, **17A**, 15–32 (1939); *Brit. Chem. & Phys. Abs.–B*, **58** [7] 723 (1939).—The diffusion coefficients of H_2O vapor through various solids used in building construction have been measured. The coefficients were used to calculate the vapor-pressure gradient through a typical wall and thus to estimate the resistance necessary to prevent the H_2O vapor from passing from the interior of the building and condensing within the wall.

Whiteware

Factors influencing the strength of clay joints: I, Moisture content of clay. A. J. DALE AND MARCUS FRANCIS. *Tech. Paper Brit. Pottery Research Assn.*, Nov., 1939; condensed and reprinted in *Trans. Brit. Ceram. Soc.*, **43** [1] 1–4 (1944).—The handling operation at a red-clay teapot factory was examined. With a body produced by blending 5 levels of the Etruria marl series, the relation between the condition of the body and its moisture content was determined. When the moisture content is between 19 and 21%, on the dry clay weight, the body is leather hard. Below approximately 20% moisture, the body is sufficiently hard to resist deformation by a weight of 1 kg. falling through 16 cm. onto a cylinder 4 cm. high and 3 cm. in diameter. The main drying con-

traction stops at a moisture content of 13%, when about half the free water of the plastic state has evaporated. Below 13%, air-filled pores form, and the body reaches the "white-hard" condition at about 5% moisture content. All joints were made with both sections at the same moisture content. The range investigated was 8 to 22%. When the moisture content of the parts to be joined is below 18%, the dry strength of the joint is low. With moisture contents above 18%, there is no marked variation in dry strength. At moisture contents higher than 22%, the material is too soft for handling without risk of deformation. R.A.H.

Flow properties of coating clays at high rates of shear. KENNETH A. ARNOLD. *Paper Trade Jour.*, **117** [9] 28–34 (1943).—A procedure has been developed for measuring the flow properties of coating-clay slips at rates of shear in the range of 8.0×10^4 reciprocal seconds, which is the range produced in high-speed coating machines. A method is presented for the quantitative determination of the degree of dilatancy and thixotropy of clay slips. In general, the flow properties of clay slips changed considerably with the amount of mechanical work to which they were subjected. In ball milling, the slips showed an initial increase in viscosity to a minimum point and then a gradual increase in viscosity over several hours' milling. The test for hydration of the clay particles indicated a gradual increase in this property during milling. Greater changes took place during the milling of slips containing comparatively low percentages of the dispersing agent. By careful selection of the amount of work applied, the amount of dispersing agent used, and the concentration of clay, it was possible to prepare slips from different clays which showed very similar flow properties. W.R.B.

Mycalex. LAWRENCE E. BARRINGER. *Gen. Elec. Rev.*, **47** [4] 53 (1944).—Mycalex is a composition of ground mica and silicates in varying proportions. Fabrication is carried out at high temperatures by compression or injection molding methods. It is used principally as an insulating material in all types of electrical circuits. Mycalex has most of the advantages of corresponding ceramic materials, such as steatite, porcelain, and glass, in that it has high dielectric strength and a low power factor and is heat resistant, noncarbonizable, impervious, and durable. In addition, it can be finished in accurately dimensioned molds, is readily machinable, can be punched from thin plates, can be combined during molding with metallic components, can be injection molded to close tolerances with thin-walled sections and metal inserts, and is not fragile. These properties have given Mycalex an important place in the field of electrical insulation. See "Machining . . . ," *Ceram. Abs.*, **23** [7] 122 (1944). C.W.

Short general survey of mechanization in the pottery industry. J. A. JOHNSON. *Trans. Brit. Ceram. Soc.*, **43** [2] 29–37 (1944).—J. discusses the present-day factors governing mechanization and methods and tendencies of mechanization. R.A.H.

Study of factors involved in glaze-slip control: I, Glaze-slip specifications. C. G. HARMAN AND C. F. SCHAEFER. *Jour. Amer. Ceram. Soc.*, **27** [7] 202–207 (1944). **II, Correlation of glaze thickness with air permeability.** C. G. HARMAN AND M. K. BLANCHARD. *Ibid.*, pp. 207–209. **III, Additional glazes and improved technique and apparatus.** C. G. HARMAN AND H. C. JOHNSON. *Ibid.*, pp. 209–14. **IV, Practical uses for coherence value and receptivity measurements.** C. G. HARMAN AND H. C. JOHNSON. *Ibid.*, pp. 214–20.—7 references, 40 figures.

PATENTS

Apparatus for the production of pottery ware. J. WEDGWOOD & SONS, LTD., AND C. T. WEDGWOOD. Brit. 560,978, May 10, 1944 (Feb. 10, 1943).

Effecting seal between center electrode and insulator of spark plug. J. A. JEFFERY (Champion Spark Plug Co.). U. S. 2,351,128, June 13, 1944 (Feb. 23, 1942).

Electrical discharge device. H. H. RACE (General Electric Co.). U. S. 2,351,066, June 13, 1944 (May 15, 1942).

Spark plug. L. A. HYLAND (Bendix Aviation Corp.). U. S. 2,352,480, June 27, 1944 (Oct. 9, 1928).

Spark-plug manufacture. AC-SPHINX SPARKING PLUG CO., LTD., AND D. H. CORBIN. Brit. 561,118, May 17, 1944 (Nov. 6, 1942). H. R. FEICHTER (U. S. Quarry Tile Co.). U. S. 2,351,029, June 13, 1944 (May 20, 1942).

Spark-plug structure. L. A. HYLAND (Bendix Aviation Corp.). U. S. 2,352,481, June 27, 1944 (July 1, 1929).

Ventilated closet bowl. A. W. THOMPSON AND J. B. ARMSTRONG. U. S. 2,351,560, June 13, 1944 (Aug. 5, 1943).

Equipment and Apparatus

Construction and design of electron tubes. K. LANGER. *Feinmech. & Präzision*, **51**, 53–58, 97–103 (1943).—L. reviews problems and their solutions in the internal parts as well as in the use of the tubes in instruments, directly and indirectly heated triodes, rectifier tubes, pentodes, hexodes, high-frequency pentodes and hexodes, and compound tubes. He describes ceramic disks, mica disks, heating of the cathodes, grids, the design of steel tubes, the design of tubes for special purposes and official use, the external shape of the tube, and its installation in the instrument. P.G.

Crane and sheave inspection. R. B. JAMES. *Safety Eng.*, **87** [6] 42, 44 (1944).—J. recommends that all slew cranes be sent twice a month to the garage for greasing and inspection. The method of inspecting and lubricating the cable and sheaves is discussed. Shiny sections; flattened areas; bulges or broken wires in the cables; worn, cracked, or burred sheaves; and improper sheave and cable proportion are conditions which require correction. M.R.

Dispersion of pigments and fillers for microscopical examination. LEWIS B. MILLER. *Paper Trade Jour.*, **116** [1] 39–42 (1943).—M. describes a method for dispersing inorganic powders of a wide range of particle sizes to make satisfactory microscopic examination. The preparation of a permanent slide is detailed. The treatment of the subject is quite complete. 11 illustrations. W.R.B.

Drying of clay and clayware in a modern pottery. A. WILLIAMS-GARDNER. *Trans. Brit. Ceram. Soc.*, **43** [2] 37–48 (1944).—Up to the present, modern knowledge of drying has been applied chiefly to batch-treatment equipment, principally to fit in with existing factory arrangements. In the future it will be quite possible to provide a pottery of modern design with all its drying equipment fully mechanized. Fuel costs, handling charges, quality of ware, and working conditions will show considerable improvement over those experienced in this industry in the past. R.A.H.

Effect of number of vibrations on the quality of castings in molding on vibratory molding machines (shakers). ANON. *Giessereipraxis*, **63** [21] 258 (1942).—An investigation showed the following results:

No. of vibrations	No. of molds made	Rejects of castings (No.)	(%)
60–65	41	15	37.0
65–70	60	12	20.0
70–75	23	3	13.0
75–80	46	5	10.4
80–85	31	3	9.8
85–90	31	7	20.0
90–95	18	4	22.0

The optimum was obtained with 80 to 85 vibrations. The increasing number of rejects at higher numbers of vibrations, which seems contradictory to the greater density of the sand with the greater number of vibrations, is

ascribed to the fact that cracks are produced in the form, and shifting of the sand takes place which can make the mold completely unusable. Every machine and every type of article to be made will have an optimum of vibrations for best production. M.HA.

Flowmeters measure rapidly fluctuating flow. J. B. McMAHON. *Power*, **87** [10] 670–71, 709c–710b (1943).—McM. outlines the problems involved in measuring highly fluctuating flow and describes a metering system for doing this successfully. Illustrated. F.G.H.

Gear and bearing lubrication. A. F. BREWER. *Pit & Quarry*, **36** [12] 66–68 (1944).—B. discusses the proper lubrication of mining machinery and the gearing and heavy-duty bearings of such equipment in particular. Suitable lubricants are also discussed. 6 photographs. M.R.

Gold-chrome resistance alloy. A. SCHULZE. *Feinmech. & Präzision*, **48**, 77–78 (1940).—Data and tests on this alloy manufactured by W. C. Heraeus, G.m.b.H., are given; available data show that it is suitable for calibrating resistances. P.G.

Graphite-silicon carbide thermocouple and its metallurgical applications. M. BONNOT. *Rev. Mét.*, **37** [1] 16–19 (1940); abstracted in *Bull. Brit. Non-Ferrous Metals Research Assn.*, No. 130, p. 99 (April, 1940).—B. discusses the use of this thermocouple, originally developed by G. R. Fitterer. It is said to have a range of up to 2000°C. as well as great sensitivity and reliability. See *Ceram. Abs.*, **17** [3] 111 (1938).

Helium densitometer for use with powdered materials. WALTER C. SCHUMB AND EDMUND S. RITTNER. *Jour. Amer. Chem. Soc.*, **65** [9] 1692–95 (1943).—A modification of the Karns densitometer for solid materials is described, which is applicable to fine powders that do not appreciably adsorb helium and do not possess appreciable vapor pressures at room temperature. The method is accurate to ±0.1% with samples of about 0.5-cc. volume and a ratio of bulk to true density of about 0.5. Illustrated. F.G.H.

How to keep flowmeters accurate. WILLIAM C. BENNETT. *Power*, **87** [8] 527–34 (1943).—A detailed check list for use in maintaining meter accuracy is presented. Illustrated. F.G.H.

It's easy to check flowmeter accuracy. WILLIAM C. BENNETT. *Power*, **88** [5] 312–14 (1944).—B. gives a table of differential-pressure values that includes all types of head flowmeters and shows how to use these data when making simple meter calibration tests. Illustrated. F.G.H.

Material-handling methods. EZRA W. CLARK. *Bull. Amer. Ceram. Soc.*, **23** [7] 236–39 (1944).

Measurement of oscillations by means of electrical instruments. W. G. SHILLING. *Feinmech. & Präzision*, **51**, 59–66 (1943).—An oscillometer with Seignette crystal is described. All problems involved are discussed, and an extended bibliography is included. P.G.

Optical seeker for television cameras. P. R. LINDNER. *Feinmech. & Präzision*, **51**, 19–23 (1943).—The following requirements are necessary: (*a*) easy adjustment and easy recognition of attained sharpness, (*b*) simultaneous with the control of sharpness, recognition of the image section, (*c*) sharpness adjustment for all zones of the image, (*d*) observation of the light and a large field with both eyes. The screen seeker seems to be particularly suitable for television purposes. Bibliography. P.G.

Parallax indicator for small films and small-picture cameras. H. WEISE. *Feinmech. & Präzision*, **48** [6] 61–64 (1940).—W. deals with (1) geometrical parallaxes: (*a*) vanishing image, (*b*) cut-out parallaxes, and (*c*) angle parallaxes, and (2) time parallaxes. P.G.

Photomicrographs by projection. J. J. PEROT, JR., AND C. G. SCHULTZ. *Paper Trade Jour.*, **117** [23] 33–34 (1943).—A means for securing photomicrographs of pulp fibers and similar materials without the use of elaborate equipment is described. A light source, a microscope, and a printing frame are aligned along a common axis, and prints are made by projecting the image directly on sensitized paper, which is developed after suitable exposure. W.R.B.

Potentiometers as a means of temperature control and measurement. W. R. L. KENT. *Metallurgia*, **20** [115] 31–34 (1939); abstracted in *Met. Abs.* (Inst. Metals), **6** [7] 258 (1939).—The potentiometer circuit and the millivolt type of control of temperature are considered and compared. A typical two-position method of measuring the temperature and effecting its control in the furnace chamber is discussed in detail, and it is stated that the simpler the type of this control capable of being used successfully, the more desirable it is. A type of circuit used for electric-furnace control with a special "hold on" locking feature and a device utilizing a proportional and floating movement for gas control are also fully described.

Quenching furnace suitable for small specimens. E. A. OWEN. *Jour. Sci. Instruments*, **21** [4] 65–66 (1944).—A furnace is described for the rapid quenching of small specimens, in lump or in powder form, from temperatures up to about 1000°C. The specimens are enclosed in small evacuated silica, Pyrex-brand, or soda-glass containers, according to the temperature quenched from, and these are mounted in holes bored in a steel block which is supported near the center of the furnace. The arrangement is such that the temperature of the specimen during the annealing treatment, as recorded by a thermocouple, does not change before the specimen enters the quenching medium, which is usually iced water. The quenching operation is completed in about 2 sec., and the temperature of the block enveloping the specimens does not alter appreciably during the operation. Illustrated. G.A.K.

Radiology in engineering. Alternative methods of testing. S. F. DOREY. *Iron & Coal Trades Rev.*, **148** [3975] 675–76 (1944).—The principles of irradiation of materials by X rays and gamma rays, radiographic technique, and the measurement of strains are explained. M.HA.

Temperature-measuring instruments. H. F. BARNES. *Chem. Age* [London], **50** [1291] 289–93 (1944).—Unless a thermometer or pyrometer is used under precisely the same conditions as those under which it is calibrated, the reading will be erroneous. A thermometer calibrated at 100°C. with the whole stem at the reading temperature but used with most of the stem at a lower temperature may read 1°C. too low. When a thermometer is used with a protecting sheath and a metal pocket for protecting the bulb, the unknown errors arising from radiation, conduction, etc., probably exceed half a degree. The placing of the thermometer bulb where it will measure the required temperature is essential. Too often the bulb is shielded, exposed to cooling influences, or in other ways prevented from providing an accurate reading. Dials and recorders should be mounted so as to be free from vibration by adjacent machinery, passing trains, etc., and should be properly protected from the weather and from sources of heat. Bent arms on recorders and excessive pen pressure may produce inaccurate readings. The use of unsuitable charts is a common cause of error. The use of folded charts may cause an error, due to excessive friction between the pen and the chart. When two instruments expected to give the same reading differ, the error may be due to temperature lag. The only method of testing the accuracy of a thermometer is to compare it under precisely the same conditions in every respect to another of known accuracy. Merely to insert the second thermometer alongside the first may not ensure an accurate comparison. It is generally best to remove a thermometer and check it away from the plant in which it is used. For boilerhouse use, B. prefers a robust mercury-in-steel thermometer with a large bulb to an electrical instrument. Such instruments may not give an absolutely correct reading, but the errors are fairly constant. To measure the surface temperature of brickwork accurately is difficult. One method is to make two grooves 100 mm. long and 1 to 2 mm. deep, insert the thermocouples, and fill in with mortar. Another method is to drill holes to three different depths and extrapolate the readings to the surface. When measuring the surface of brickwork, errors will occur due to conduction and radiation. Lack of sufficient intimacy

of contact between the thermocouple and the surface will also cause errors. A.B.S.

Thermoelectric pyrometer. ANON. *Feinmech. & Präzision*, **51**, 24–25 (1943).—Characteristics of resistance of platinum–platinum rhodium, nickel–nickel chrome, iron–constantan, and copper–constantan are discussed, and recommendations for the selection and design of these measuring instruments are given. P.G.

Voltage stabilizer. G. N. PATCHETT. *Elec. Rev.*, **134** [3466] 602–604 (1944).—P. describes a new electronic regulator which was designed to stabilize the voltage of a 3-phase, 4-kva., 50-cycle per sec. alternator, which is driven from the 230-volt d.-c. mains by a 7-h.p. shunt motor. 2 diagrams. M.R.

Wide range sensitive thermoregulator. G. E. COATES. *Jour. Sci. Instruments*, **21** [5] 86–87 (1944).—A thermoregulator controlled by a resistance thermometer in an a.-c. bridge is described. The regulator is simple in construction and operation, since it does not involve a galvanometer or photocell or require accurate phase adjustment. Adaptable to provide continuous control, it may be used over the whole temperature range for which platinum thermometers are suitable. G.A.K.

BOOK

Industrial Radiology, X Rays and Gamma Rays. A. ST. JOHN AND H. R. ISENBURGER. John Wiley & Sons, Inc., New York, 1943. 2d ed. 298 pp. Price $4.00. Reviewed in *Mech. Eng.*, **65** [11] 827 (1943).—This book is intended to furnish, in readable form, authoritative information on the practical use of radiology in industry. The general principles governing the production and use of X rays and gamma rays are presented, together with the techniques suitable for important classes of industrial materials. 1300 references. F.G.H.

PATENTS

Abrading apparatus. W. L. KEEFER (Pangborn Corp.). U. S. 2,351,521, June 13, 1944 (July 23, 1941).

Devices for varying the grinding pressure of roller mills. BUHLER BROS. Brit. 560,594, April 26, 1944 (Feb. 28, 1942).

Drop-mud method of and apparatus for molding brick. E. G. COWAN AND J. M. CODER (General Refractories Co.). U. S. 2,352,771, July 4, 1944 (May 25, 1943).

Thickness-measuring apparatus. E. A. SPRIGG (B. F. Goodrich Co.). U. S. 2,352,571, June 27, 1944 (March 21, 1942).

Washing of filter bags. A. E. ANDERSON (Bethlehem Steel Co.). U. S. 2,351,652, June 20, 1944 (Sept. 13, 1941).—In the concentration of fine iron ores, the method of cleaning a filter fabric which consists in subjecting it to a cold solution of trisodium phosphate and water in the proportion by weight of approximately one part of trisodium phosphate to 22 to 28 parts of water.

Kilns, Furnaces, Fuels, and Combustion

Calculation of the heat transfer on reversal in a regenerator. M. LAFFARGUE. *Chaleur & Ind.*, **20**, 527–32 (1939); abstracted in *Jour. Soc. Glass Tech.*, **24** [102] 78 (1940).—The factors which affect the heat transfer in a regenerator are discussed, and formulas are developed for calculating the total heat transfer and the maximum and minimum temperature of brick surface and gas (or air). The method is illustrated by an example.

Chamber kiln or tunnel kiln in the brick industry. W. KOSNEY. *Tonind.-Ztg.*, **65**, 385, 404 (1941); abstracted in *Trans. Brit. Ceram. Soc.*, **41** [2] 19A (1942).—The two types of kiln are compared, and the following conclusions are reached. In a new plant a tunnel kiln is advantageous, although the rate of working of the chamber kiln is more readily adjusted to suit slack periods. Questions of economy depend mainly on the working conditions, especially on the raw material. Quality is stated to be independent of the kiln system, being governed rather by the preceding processes of manufacture. It is essential that a tunnel kiln be gas fired; with solid fuel, the ash contaminates the setting.

Cleaning coking coals. J. GRIFFEN. *Steel*, **110** [March 2] 80–82 (1942); abstracted in *Bull. Iron & Steel Inst.* [London], No. 77, p. 5A (May, 1942); *Woodall-Duckham Tech. Press Rev.*, No. 859, p. 2 (June 3, 1942).—G. quotes and discusses data which show the benefits obtained in the blast-furnace process in the Pittsburgh district by using coke produced from coal which has been mechanically cleaned.

Confer on possible changes in fuel oils after the war. ANON. *Heating, Piping & Air Conditioning*, **16** [6] 335 (1944).—More than a hundred representatives of oil refiners and oil-burner manufacturers held a meeting in Chicago, May 18, to consider the production and use of fuel during the first five postwar years. In general, the refinery men seemed to favor rather broad standards for the various fuel oils, with burners to be designed to handle efficiently the lowest quality of oil that might be encountered in any part of the country. The burner manufacturers preferred fairly close or definite standards for each oil, which they felt would simplify the design of burners. Heating oils of higher B.t.u. content per gallon were predicted. M.R.

Direct calculation of gas pressure drop in pipes. A. S. HALL AND R. C. BINDER. *Power*, **87** [8] 537–64c (1943).—H. figures the isothermal gas-flow pressure drop in a horizontal line by assuming the fluid to be a liquid and then corrects it by a factor taken from a simple curve. Illustrated. F.G.H.

Fuel saving in the heavy clay and refractories industries. E. ROWDEN, W. NOBLE, AND A. T. GREEN. *Claycraft*, **17** [7] 361–70 (1944).—Best advantages of recuperation of heat from the fired goods and from the kiln gases are obtained with Belgian-type continuous kilns. This type of kiln is described under the following headings: (1) fuel requirements, (2) fuel savings, (3) records, (4) standardization of schedules, (5) conditions of kilns and flues, (6) the setting, (7) moisture content of the setting, (8) kiln wickets, (9) drying with hot air, (10) preheating and oxidation, (11) the full firing and finishing stages, (12) draft conditions, and (13) air requirements. The firing efficiency of all continuous kilns depends markedly on throughput so that a prime consideration should be to obtain optimum throughput and to control the conditions required to maintain it. The suggestions given for approaching these conditions are mainly those which can be immediately applied. See *Ceram. Abs.*, **22** [3] 56 (1943). G.A.K.

Fuels and fuel research in Great Britain during the war. W. C. SCHROEDER. *Mech. Eng.*, **65** [12] 881–84, 892 (1943). F.G.H.

How to avoid errors in analyzing high-moisture coals. LEE F. CHANEY. *Power*, **88** [1] 26–70b, 70c (1944).—Illustrated. F.G.H.

Industrial furnace design, operating technique, and control. R. J. SARJANT. *Iron & Coal Trades Rev.*, **148** [3978] 794–96 (1944).—General principles of heat transmission in furnaces from chamber to material, preheating, heat storage in the furnace structure, and savings due to hot-face insulation are discussed, and the arrangement of control apparatus is briefly described. See "Efficient. . .," *Ceram. Abs.*, **23** [2] 43 (1944). M.HA.

Industrial uses of propane. CLARY, SHEELY, AND FYKE. *Welding Jour.* [N. Y.], **19** [3] 192–94 (1940); abstracted in *Bull. Brit. Non-Ferrous Metals Research Assn.*, No. 131, p. 144 (May, 1940).—A summary of information on industrial propane as used for metal cutting, metal spraying, and the welding of low-melting-point metals.

Laboratory and field tests on coal-in-oil fuels. J. F. BARKLEY, A. B. HERSBERGER, AND L. R. BURDICK. *Trans. Amer. Soc. Mech. Engrs.*, **66** [3] 185–98 (1944).—

It has been determined from extensive laboratory and field tests on the stability of coal suspensions in fuel oil that each installation must be given individual consideration if satisfactory results are to be obtained; however, no particular difficulty in devising equipment or operating routine for efficient use need be experienced. A sufficiently stable suspension of coal in oil for practical purposes can be prepared by dispersing 40% coal by weight ground to 98–99% through a 230-mesh screen in heavy fuel oil. Careful control of storage and handling temperatures is required for most successful operation. Combustion efficiency is likely to be slightly less than that of fuel oil. The best opportunity for the successful use of coal-in-oil suspensions is in the larger plants with better operating personnel and more readily accessible equipment. Illustrated.

F.G.H.

Lignite—influence of storage conditions on size degradation, size stability, and friability. C. J. ECKHARDT, JR., AND C. W. YATES. *Trans. Amer. Soc. Mech. Engrs.*, **65** [8] 829–36 (1943).—This paper is presented to focus attention on the little-known possibilities of lignite as a direct source of potential energy for power-generating and industrial purposes, for the manufacture of gaseous fuels, and for the manufacture of liquid fuels. More than 18% of the nation's reserve of mineral fuels consists of lignite, but only an insignificant fraction of this low-rank solid fuel is being utilized. Test data are presented to dispel misconceptions concerning the characteristics of lignite which today stand in the way of its more extended use. The most serious of these relates to its tendency to undergo size-reduction processes while in storage and being handled. Nevertheless, it has been demonstrated that it is possible to store this fuel with complete satisfaction, the conclusions reached from the tests described giving factual support to the possibilities in this direction. Size stability, or measure of the ability of lignite to withstand a reduction in size of particles when being handled, and friability tests are also reported. Illustrated. F.G.H.

Numerical solution of heat-conduction problems. H. W. EMMONS. *Trans. Amer. Soc. Mech. Engrs.*, **65** [6] 607–15 (1943).—Two- and three-dimensional steady-flow heat-conduction problems are readily solved to any degree of approximation by application of the relaxation method introduced by Southwell. Except for the simplest geometric shapes and boundary conditions, the relaxation method is far superior to analytical methods of solution in point of time required to reach a given desired accuracy. The relaxation method has the further advantages of permitting the calculator to put into the calculation all the physical intuition he may have about the problem and, at the same time, to know at each step just how seriously his solution still differs from the correct answer. By an extension of the method, 1-, 2-, and 3-dimensional transient-heat-flow problems are easily solved. For 1-dimensional problems, the new method is identical with the graphical method of Schmidt. Illustrated. F.G.H.

Overfire air jets. R. B. ENGDAHL AND W. C. HOLTON. *Trans. Amer. Soc. Mech. Engrs.*, **65** [7] 741–54 (1943).—For many years overfire air jets have demonstrated their effectiveness for smoke abatement as well as for increasing the ratings of existing furnaces. Except for the chain-grate stoker on which fan-driven overfire air jets have become standard equipment, jets in this country have been actuated mainly by high-velocity steam from nozzles. Their wide use has been due largely to a minimum of engineering and auxiliaries, in spite of demonstrably poor efficiency and high steam consumption. Because of uncertainty as to the effects of variables involved in a steam jet, there has been reason to believe that, among the available types, there are some which might compare favorably in economy with fan-driven jets. To determine the relative performances of steam jets and fan-driven overfire jets, the authors undertook a laboratory study of the problem at Battelle Memorial Institute for Bituminous Coal Research, Inc. The results are given and compared with the meager information which had been made available from earlier investigations. Illustrated. See *Ceram. Abs.*, **23** [3] 61 (1944). F.G.H.

Thermal insulation of kilns. F. VOGELER. *Tonind.-Ztg.*, **62**, 87–89 (1938); *Brit. Chem. & Phys. Abs.–B.*, **57** [4] 373 (1938).—The use of a layer of heat insulation, e.g., kieselguhr or brick made from it, costs little in comparison with the economy which it effects in heat.

Wartime fuel efficiency. K. STEINER. *Heating, Piping & Air Conditioning*, **16** [6] 331–35 (1944).—The U. S. Bureau of Mines is sponsoring a concerted national fuel efficiency drive to encourage conservation of coal and other fuels by more efficient utilization. S. outlines the fundamentals of coal combustion to aid operating men in meeting this growing need for fuel conservation. 1 photograph, 1 diagram. M.R.

BOOK

Heat and Thermodynamics. M. W. ZEMANSKY. McGraw-Hill Book Co., Inc., New York, 1943. 2d ed. 390 pp. Price $4.00. Reviewed in *Mech. Eng.*, **66** [1] 77 (1944). F.G.H.

Geology

Clay preparation and disintegration. K. SPINGLER. *Ziegelwelt*, **70**, 149 (1939); abstracted in *Trans. Brit. Ceram. Soc.*, **39** [6] 51A (1940).—The development of the various machines for the wet and dry preparation of clays is traced, the principles underlying the preparation and disintegration of clay, rather than the operation of individual machines or groups of machines, being dealt with. In general, present-day methods represent a combination of the use of modern mechanical appliances and the old-fashioned clay-weathering process, now largely mechanized.

Diatomite in Brazil. ANON. *Bull. Imperial Inst.*, **38**, 240 (1940); abstracted in *Trans. Brit. Ceram. Soc.*, **39** [11] 101A (1940).—A brief account is given of the various deposits of diatomite in Brazil. Chemical analyses of eight materials are given, in which the SiO_2 content varies from 51.7 to 87.9%. See *Ceram. Abs.*, **21** [7] 152 (1942).

Experiments on plasticity: I and II. H. H. MACEY. *Bull. Brit. Refractories Research Assn.*, No. 51, p. 40 (1939); No. 58, p. 43 (1941); rewritten in *Trans. Brit. Ceram. Soc.*, **43** [1] 5–28 (1944).—Two fundamentally simple methods of experiment on plastic clay are given, and the data obtained by these methods are discussed. Clay bars were subjected to constant tension and compression stresses, less than those necessary to produce continuous flow. It is shown that clay is not elastic but deforms plastically even at the smallest stresses. Deaired clay bars were extended at a constant speed, and a continuous record of the stress involved was obtained. A wide range of speeds was used, and M. shows how the behavior of the bars varies with the speed. The extension to maximum stress increases considerably as the rate of extension is increased. The discussion is restricted almost entirely to that part of the deformation up to the maximum stress. Considerable variations in the behavior of apparently identical bars are found, but the stress-extension curves are in good general agreement with the formula $f = B(1 - e^{-aE})$, where f is the true stress per unit area. E is the extension, and a and B are constants for any one experiment. R.A.H.

Geological notes on French West Africa. ANON. *Mine & Quarry Eng.*, **9** [4] 90–95 (1944).—An abstract based principally on "Esquisse Géologique de l'Afrique Occidentale Française," by P. Legoux, *Bull.* No. 4, Serv. des Mines, Dakar, 1939, and "Description Petrographique et Étude Géologique de la Region Forestière de la Guinée Française," *Bull.* No. 5, Serv. des Mines, Dakar, 1941. General geology and economic geology are dealt with, including iron ores, diamonds, phosphates, gold, manganese, copper, chromium, ilmenite, and rutile. E.R.V.

Geology of the chromite deposit of Jojohatu, Singhbhum. B. S. BHADAURIA. *Quart. Jour. Geol. Mining & Met. Soc. India*, **11**, 123–32 (Sept., 1939); abstracted in *Jour. Iron & Steel Inst.* [London], **142** [2] 173A (1940).—B. gives a brief account of the geology of the chromite deposit of Jojohatu in the hilly portion of Singhbhum, which is the chief mining locality for the supply of chrome ore to the Tata Iron & Steel Co., Ltd.

Physical characteristics of soils: VII, Effect of ignition. A. N. PURI AND A. G. ASGHAR. *Soil Sci.*, **49**, 369–78 (1940); *Brit. Chem. & Phys. Abs.–B*, **59** [11] 816 (1940).—Heating soil at ranges of temperature up to 910° resulted in a progressive increase in p_k without any well-defined change in $T/2$ value. Base-exchange capacity remained constant up to 400° but diminished steadily at higher temperature. The NH_3-combining capacity of the clay diminished with rise in temperature, curves showing a point of inflection at 300° to 500°. Loss of weight of soils occurred largely at temperatures below 500°. Moisture absorption at all ranges of relative humidity decreased with rise in temperature in parallel with diminution in clay content due to dehydration. The pozzuolanic properties of heated soil improved with the temperature of ignition. The rolling-out limit and sticky-point moisture were not greatly affected by heating to 400°; higher temperature caused loss of plasticity, the soil behaving like sand. For Part **VI** see *Ceram. Abs.*, **19** [8] 199 (1940).

Structural viscosity studies of coating clay compositions. GEORGE H. SHEETS. *Paper Trade Jour.*, **116** [3] 28–36 (1943).—S. presents a thorough study of the flow properties of clays with respect to the paper manufacturer. An instrument for measuring and distinguishing thixotropy, dilatancy, plasticity, and Newtonian flow is described; suitable techniques for the use of this instrument have been developed. Several representative coating clays were studied, and large differences in flow properties were found to exist. These differences are attributed to differences in clay species and in their hydrating ability. The amount of dispersing agent is the most important single variable and exerts the greatest effect upon the flow properties of the clay suspensions studied. Sodium silicate and sodium pyrophosphate were studied. With one exception there was little difference in the action of sodium silicate as compared to sodium pyrophosphate in regulating the flow properties of the clays studied. The one exception was in the case of an English clay where an excess of sodium silicate over the amount required for minimum viscosity resulted in a marked thickening effect. It is possible to have clay systems which possess simultaneously both dilatancy and thixotropy in the same slip.

W.R.B.

Transportation of suspended sediment by water. V. A. VANONI. *Proc. Amer. Soc. Civil Engrs.*, **70** [6] 793–828 (1944).—Measurements of the sediment and velocity distributions in a laboratory flume were made for various values of rate of flow, slope of channel, and size and amount of suspended load. The experimental sediment-distribution measurements were compared with the theoretical distribution derived on the assumption that the coefficient for the turbulent transfer of suspended sediment is the same as the coefficient for the turbulent transfer of momentum. Conclusions were as follows: (1) The measured sediment distributions have the same form as the theoretical distributions but do not agree quantitatively with them. (2) Suspended sediment in a flow tends to reduce appreciably the turbulent transfer of momentum and hence the resistance to flow, allowing the sediment-laden water to flow more rapidly than a comparable clear water. (3) Suspended load in a flow may be a factor in causing the secondary circulation observed in rivers. 19 diagrams, 2 photographs.

M.R.

Use of nonmetallic minerals in the ceramic industry. A. F. GREAVES-WALKER. *Bull. Amer. Ceram. Soc.*, **23** [7] 229–31 (1944).—An editorial.

SEPARATE PUBLICATION

Fluorescent Minerals Used in Lighting and Elsewhere. OLIVER C. RALSTON AND A. GEORGE STERN. *U. S. Bur. Mines Information Circ.*, No. 7276, 18 pp. (April, 1944). Free.—Fluorescence is defined, and fluorescent lighting and minerals are discussed.

R.A.H.

PATENTS

Beneficiation of feldspathic and similar ores. W. G. HUBLER (American Nepheline Corp.). U. S. 2,352,324, June 27, 1944 (March 21, 1939).

Chemistry and Physics

Application of phosphorescence spectra to the investigation of the structure of solids and solutions. R. TOMASCHEK. *Trans. Faraday Soc.*, **35**, 148 (1939); abstracted in *Jour. Soc. Glass Tech.*, **23** [97] 126 (1939).—The glassy state represents a special type quite different from that of the crystalline as well as of the liquid state, giving typical "glass" spectra. It is distinguished from the liquid state by a decrease of the binding forces, the intensity of which varies in a wide range. For the formation of glasses, the primary effect of the strongest forces is to build up the internal structure of the network, while in the case of solutions the main effect is the solvation. Thus, the essential factors for glass are the groupings around the primary cation and their mutual binding, while only the valency fields (extending more widely because of that structure) remain for the secondary cation. In the case of a solution, however, the ionic forces designated as secondary in glass are responsible for the binding and also for the solvation. See "Optics. . .," *Ceram. Abs.*, **20** [3] 74 (1941).

Chemistry in the postwar period. EDWARD R. WEIDLEIN. *Bull. Amer. Ceram. Soc.*, **23** [7] 243–45 (1944).

Electrochemical properties of colloidal silicic acid: I, Interaction with bases; II, Interaction with neutral salts. B. CHATTERJEE. *Jour. Indian Chem. Soc.*, **16**, 589, 607 (1939); abstracted in *Brit. Chem. Abs.–A*, **1940**, I, 112; *Trans. Brit. Ceram. Soc.*, **39** [5] 49A (1940).—The interaction of silica sols with different bases—NaOH, $Ba(OH)_2$, $Ca(OH)_2$—has been studied potentiometrically. The sols behave as strong acids, as shown from a comparison of the free and total acidities at the first inflection points of the sols and of their ultrafiltrates. First inflection points in the titration curves indicate the full neutralization of an acid between pH 4.5 and 5.6. From a comparison of the slopes of the various titration curves, $Ca(OH)_2$ reacts more strongly than $Ba(OH)_2$, and NaOH least, but the H_2SiO_3 neutralized by these bases is the same at the respective inflection points. A second inflection point has been observed between pH 11.0 and 11.7, using concentrate NaOH, and the lower the SiO_2 concentration of the sol, the lower the pH of this point. The total acidity calculated from the second inflection point is approximately equal to the SiO_2 concentration of the sol expressed in gm.-mol. per liter. The formation of $NaHSiO_3$ at the second inflection point is indicated. The power of different cations to liberate acid from colloidal silica, in decreasing order, is Ba″, Ca″, Na′, and Li′, in agreement with the theory of interchange between H′ ions in the double layer of the colloidal particles of the sol and the cations of the added salts.

Hytemp paint stands extreme heat. ANON. *Ind. Finishing*, **20** [4] 72 (1944).—A protective coating, chrome green in color and capable of resisting temperatures up to 3000°F., is composed of several mineral substances with chromic oxide as the base. This paint is marketed as Hytemp and is a product of the Geo. R. Mowat Co., New York 18, N. Y.

C.W.

Investigation of reactions of simple magnesia spinels with alkaline earth orthosilicates in the solid state. V. D. FRÉCHETTE AND A. I. ANDREWS. *Jour. Amer. Ceram. Soc.*, **27** [7] 197–202 (1944).—29 references, 3 figures.

Merwinite in the system CaO–MgO–SiO_2. T. W. PARKER AND R. W. NURSE. *Jour. Iron & Steel Inst.*

[London], **148** [2] 475–88P (1943); abstracted in *Refrac. Jour.*, **19** [6] 181–84, 187–91 (1943); *Iron & Coal Trades Rev.*, **146** [3928] 877 (1943).—Merwinite has been known for some time as both a natural and an artificial mineral, but it has not been detected as a stable phase in the system $CaO–MgO–SiO_2$. The primary phase field of merwinite has now been established in this system, and the position of the invariant points with the neighboring fields of larnite, akermanite, monticellite, and periclase is given. The pure mineral melts incongruently at 1590°C., forming $2CaO \cdot SiO_2$ and liquid. The application of the data to problems of dolomite-silica refractories is discussed. Compositions of this type should be completely stable to both falling and hydration under all conditions of heating and cooling when the $CaO:SiO_2$ ratio is less than 1.20, but such mixtures form relatively large percentages of melt at fairly low temperatures and therefore would probably not be satisfactory refractories. Falling blast-furnace slags can be stabilized by substituting MgO for part of the CaO in the slag composition, and, in practice, it appeared that stabilization by this means covered a wider composition range than could be predicted on existing phase data. The interposition of a merwinite primary field leads to deductions giving greater agreement between theory and practice. The data also provide confirmation of one point in Bowen's studies on the metamorphosis of siliceous limestone. V.D.F. & M.Ha.

***New mathematical theory of plasticity.** W. Prager. *Rev. Faculté Sci. Univ. Istanbul*, **A5** [3–4] 215–26 (1940); abstracted in *Physik. Ber.*, **23** [18] 1682 (1942).—The work of previous authors is reviewed, and the phenomena of transition from the elastic to the plastic condition are discussed. A mathematical theory of plasticity in the case of a tension in one plane is developed. M.Ha.

Quaternary system $CaO–Al_2O_3–CaSO_4–H_2O$ at 25°C. F. E. Jones. *Trans. Faraday Soc.*, **35,** 1484 (1939); abstracted in *Trans. Brit. Ceram. Soc.*, **39** [3] 27A (1940).—A study of the quaternary system $CaO–Al_2O_3–CaSO_4–H_2O$ was undertaken to determine the precise conditions of formation of the calcium sulfoaluminates arising during the setting of Portland cement by the action of sulfate waters on concrete. This work at 25° includes crystalline $Ca(OH)_2$ and the gel form of hydrated alumina as solid phases. That portion of the system of particular interest in cement chemistry has been worked out, and a space model was constructed. The following main conclusions are drawn: Only the high sulfate form of calcium sulfoaluminate occurs. This compound is incongruently soluble in water and in dilute solutions of both lime and calcium sulfate. Above a certain concentration of calcium sulfate it is stable, but in lime solutions it is congruently soluble only within a limited range of concentrations. Curves previously reported by various authors expressing the concentrations of solutions obtained by shaking $3CaO \cdot Al_2O_3 \cdot 3CaSO_4 \cdot 32H_2O$ with lime and calcium sulfate solutions are shown to consist in part of the boundary curve $3CaO \cdot Al_2O_3 \cdot 3CaSO_4 \cdot 32H_2O–Al_2O_3$ aq. and in part of a section of the $3CaO \cdot Al_2O_3 \cdot 3CaSO_4 \cdot 32H_2O$ field. The nature of the calcium sulfoaluminate formed in hydrated Portland cement is discussed, and the application of the results to the attack of calcium sulfate waters on concrete is considered.

Separation of iron and manganese by the acetate process. R. Höltje with A. Scheer and C. Optiz. *Z. Anorg. & Allgem. Chem.*, **243,** 252–58 (1940); abstracted in *Jour. Soc. Glass Tech.*, **24** [105] 294 (1940).—From dilute ferric chloride solution, $Fe(OH)_3$ was precipitated in the pH range 3.5 to 6.0; in the presence of sodium acetate the range was 4.6 to 6.0. Precipitation of the basic acetate was best carried out at pH 4.0 to 4.8 and 60° to 80°; coprecipitation of manganese was negligible at pH < 4.9 and small at pH > 6.0. Addition of hydrogen peroxide increased the coprecipitation of manganese, especially at higher pH values.

Sources of error in precision viscometry. L. A. Steiner. *Chem. Age* [London], **50** [1295] 385–88 (1944).—The usual ratio of efflux time of solution to efflux time of solvent is not necessarily the ratio of the true viscosites and may lead to serious errors. The viscosity of a substance is not characteristic, but its viscosity-time curve is definitely so, and the difference can be used to identify some materials either alone or in mixtures. The calibration of a capillary viscometer, determined at one point, is not necessarily constant for the whole range of the viscometer. Two viscometers of the same type and range may exhibit errors which vary with the efflux time. Some viscometers have a low reproducibility, so that no fixed value can be given to the calibration constant. Only viscometers which have been shown to be free from erratic behavior should be used. A calibration graph may not fit the official formula. The close control of temperature is essential, as some substances show a decrease of 50% in viscosity with a rise of only 5°C. A constant-temperature ball with an accuracy of 0.01°C. should be used; one operated by electronic control gear is to be preferred to one with a resistance control. Stop watches and mains-driven electric clocks are not sufficiently reliable for precision work, but a timing device designed by S. (described in *Petroleum*, **6,** 72 (1943)) is much more accurate and can drive many recorders. A rolling-sphere viscometer has several advantages for determining the viscosity of fluids within an error of 0.1%. A.B.S.

Specific heat of silver, nickel, β-brass, quartz crystals, and quartz glass. H. Moser. *Physik. Z.*, **37,** 737–53 (1936); abstracted in *Jour. Soc. Glass Tech.*, **25** [107] 5 (1941).—The primary heat-supply method of Perrier and Roux was used. Experiments were carried out under practically adiabatic conditions, using a silver calorimeter which is described in detail. Owing to the difficulty of maintaining a good vacuum at high temperatures, the experiments were performed in an atmosphere of argon at reduced pressure. An absolute accuracy of ±0.5% was claimed. The specific heat of quartz crystals and fused silica at various temperatures is as follows:

Temp.	Quartz crystals	Fused silica
0°	0.1718	0.1685
50	0.1890	0.1839
100	0.2040	0.1989
150	0.2178	0.2131
200	0.2309	0.2255
250	0.2427	0.2354
300	0.2525	0.2440
350	0.2614	0.2501
400	0.2686	0.2563
450	0.2767	0.2615
500	0.2890	0.2659
550	0.3135	0.2690
600	0.2692	0.2720
650	0.2712	0.2742
700	0.2732	0.2761

Below the change point from α- → β-quartz, at 574°, the following equations were found to hold between the difference in the specific heats of the crystals (c_p) and the glass (c_v):

$$c_p - c_v = 2.60 \times 10^{-4}\, T/(\sqrt{874 - T}) = (\alpha^2 T)/(x d_0) \times F,$$

where T = temperature (°abs.), α = expansion coefficient, x = cubical coefficient of compression, d_0 = density at 0°, and $F = 2.39 \times 10^{-8}$ cal./erg.

Treatment of chromiferous ores with sulfuric acid in presence of oxidants: II. K. I. Losev. *Zhur. Priklad. Khim.*, **13,** 170–80 (1940); *Brit. Chem. & Phys. Abs.–B*, **59** [8] 601 (1940).—Chromite ore is treated with 8% CrO_3 in 75% H_2SO_4 (2.5 ml. per gm. of ore; 3 hr. at the boiling point), when 85% of the Cr passes into solution. Ninety-eight per cent of the dissolved Cr may be recovered as $Cr_2(SO_4)_3$, contaminated with Fe^{III} and Al sulfates; these contaminants may be eliminated by treatment with $CaCO_3$ (12 hr. at room temperature). Alternatively, the extract is subjected to electro-oxidation and concentration, when

* Obtained from microfilm.

CrO_3 separates in 93% yield. The mother liquors are returned to the extraction process after crystallization of Fe and Al sulfates.

***Viscosity of the system Na_2SiO_3–SiO_2 in the molten state.** M. M. SKORNYAKOV, A. YA. KUZNETSOV, AND K. S. EVSTROP'EV. *Zhur. Fiz. Khim.*, **15**, 116–23 (1941); abstracted in *Physik. Ber.*, **23** [18] 1697 (1942).—An investigation of the viscosity of glasses of the system Na_2SiO_3–SiO_2 in the temperature range 800° to 1400°C. showed that the formula $\log \eta = A + (\alpha_1/T^2)$ can also be applied for the sodium silicate glasses and some industrial glasses. The dependence of $\log \eta$ on composition is expressed by uniform curves with a discontinuity in the range of the Na tetrasilicate. The minima found by Preston in the range of $Na_2O \cdot 2SiO_2$ and $Na_2O \cdot 3SiO_2$ were not observed, and his conclusion with regard to the molecular equilibrium in vitreous melts was found to be incorrect. M.HA.

***Viscosity of the system SiO_2–PbO.** A. S. KONOVALOV AND K. S. EVSTROP'EV. *Zhur. Fiz. Khim.*, **15**, 109–15 (1941); abstracted in *Physik. Ber.*, **23** [18] 1696–97 (1942).—In an investigation of the viscosity of nine glasses of the system SiO_2–PbO in the temperature range 600° to 1400°C., it was found that the viscosity of lead silicate glasses and of some industrial glasses can be expressed by the empirical term $\log \eta = A + (\alpha/T^2)$, where A and α are constants depending on the composition of the glass. The viscosity-composition curve has no particular points in the range of *m*- and *o*-lead silicate. The lower the temperature at which the isotherm is selected, the more the viscosity of the melt changes with the composition. The dependence of $\log \eta$ on composition can be considered as a curve composed of three straight lines intersecting at points corresponding to 50 and 66.6 mole % PbO. M.HA.

X-ray investigation of silica acid gels. S. K. DUBROVO. *Compt. Rend. Acad. Sci. U.R.S.S.*, **23**, 50 (1939); *Brit. Chem. Abs.–A*, **1939**, I, 470; *Trans. Brit. Ceram. Soc.*, **39** [1] 8A (1940).—Silicic acids, prepared by the action of HCl on a solution of sodium silicate and by hydrolysis of $SiCl_4$, although of different pH, have the same molecular structure, containing crystallites of cristobalite and tridymite less than 10^{-5} cm. When heated to 900° to 950°, they give a diagram showing definite crystalline structure. The product from the gels obtained from $SiCl_4$ is a mixture of cristobalite and tridymite. The presence of 10% $CuCl_2$ in the gel does not affect the crystalline structure, but with 10% $BaCl_2$ crystallization is favored.

BOOKS

Industrial Chemistry of Colloidal and Amorphous Materials. WARREN K. LEWIS, LOMBARD SQUIRES, AND GEOFFREY BROUGHTON. Macmillan Co., New York, 1942. 540 pp. Price $5.50. Reviewed in *Jour. Amer. Chem. Soc.*, **66** [5] 853(1944).—The technology and scientific interpretations of many colloidal and amorphous materials, including clays and glass, are discussed. As a foundation for this discussion, the first half of the book is devoted to a review of physics and of colloid science, beginning with the structure of liquids and proceeding through viscosity, surface tension, orientation, adsorption, suspensoids, amorphous solids, emulsoids, electrochemical behavior of colloids, and gelatin to plastic distortion and flow. F.G.H.

Optical Crystallography. ERNEST E. WAHLSTROM. John Wiley & Sons, Inc., New York, 1943. 206 pp. Price $3.00. Reviewed in *Jour. Amer. Chem. Soc.*, **66** [4] 664 (1944); *Mech. Eng.*, **66** [3] 208 (1944).—W.'s purpose is to review the principles of optical crystallographic theory. Practical applications are treated briefly, as the emphasis is placed on the thorough presentation of fundamental concepts. Some space is given to a description of the techniques for the measurement of refractive indices. The text is profusely illustrated, a particularly helpful feature in a book on this subject. F.G.H.

* Obtained from microfilm.

PATENTS

Lead-free enamel. A. J. DEYRUP (E. I. du Pont de Nemours & Co.). U. S. 2,352,425, June 27, 1944 (June 10, 1942).—A lead-free vitrifiable ceramic glaze composition suitable for decorating glassware and maturing below about 1150°F. to a glossy decorative surface coating, the glaze composition comprising aluminum oxide present in amounts ranging from 12 to 17 mole %; boric oxide present in amounts ranging from 25 to 40 mole %; silica present in amounts ranging from 5 to 25 mole %; at least one of the oxides of an alkali metal having an atomic weight below 40 present in amounts ranging from 13 to 24 mole %; and an oxide selected from the group which consists of barium, strontium, calcium, magnesium, and zinc oxides present in amounts ranging from 6 to 20 mole %, all mole percentages being based on the total weight of the glaze composition.

Making magnesium oxide. AMERICAN ZINC, LEAD & SMELTING CO. Brit. 560,600, April 26, 1944 (Nov. 21, 1941).

Manufacture of alkali-metal silicates. R. F. RUTHRUFF. U. S. 2,352,738, July 4, 1944 (Jan. 15, 1940).—In the manufacture of alkali-metal silicates, the steps including suspending particles comprising aggregates of an alkali-metal compound and a siliceous material in a moving stream of heated gas wherein the particles are subjected to reaction conditions to effect the formation of molten particles of alkali-metal silicates, cooling the resulting suspension to solidify the particles of alkali-metal silicates, and separating the solidified particles of alkali-metal silicates from the gas stream.

Preparing anhydrous sodium orthosilicate. EDUARD ZINTL (vested in the Alien Property Custodian). U. S. 2,351,385, June 13, 1944 (Dec. 19, 1940).—A process of preparing anhydrous sodium orthosilicate in a single heating step which comprises heating a mixture of caustic soda and a compound of the group consisting of silicic acid, sodium metasilicate, and sodium disilicate in proportions to form the orthosilicate to a temperature between 300° and 402°C. while maintaining the partial pressure of water vapor above the reaction mixture below that calculated according to the equation $\log p_2$ (mm.) $= -$ (11980/ $4.571 \cdot T$) $+$ 6.268, wherein T is the absolute temperature on the centigrade scale.

Producing magnesium oxide. WILHELM MOSCHEL, WILLI FORST, AND WALTHER SCHMID (vested in the Alien Property Custodian). U. S. 2,351,998, June 20, 1944 (July 23, 1940).—The process for the production of magnesium oxide of high chemical reactivity which comprises heating a substantially dry magnesium compound of the group consisting of magnesium hydroxide and magnesium carbonate, the magnesium compound having a substantially uniform grain size below 10,000 mesh per sq. cm., to a temperature of about 800°C. to 1100°C. for a period of about 0.1 sec. to about 2 min.

Production of cadmium red. JOHANNES LOEFFLER (vested in the Alien Property Custodian). U. S. 2,351,985, June 20, 1944 (Aug. 2, 1940).—A process for preparing cadmium-red pigments which consists in heating a mixture containing cadmium sulfide and selenium, there being present in the mixture during the heating a material which will react with and thus remove the free sulfur liberated during the process.

General

Drilling and blasting practices in the Lehigh Valley District. H. I. PHEMISTER. *Pit & Quarry*, **36** [12] 58–60 (1944).—A general discussion of drilling and blasting practices in the Lehigh cement district is presented. Historical references touch upon the American cement industry, explosives, and drilling equipment. 5 photographs. M.R.

Engineering control of some solvent hazards in war

industries. S. C. ROTHMAN. *Heating, Piping & Air Conditioning*, **16** [6] 370–76 (1944).—The toxic effect of various chemicals and solvents (particularly those used in war industries) is reviewed. R. discusses the reaction of the individual upon exposure and the means of controlling or preventing such exposure. Properties of 21 solvents are listed. 19 references, 1 diagram. M.R.

Production control. J. T. HORNER. *Claycraft*, **17** [8] 415–27 (1944).—H. reviews the problem of production control under wartime conditions with a view to keeping up to date with altering conditions and circumstances. The following topics are covered: (1) the human element, (2) development of functional administration, (3) application of production control, (4) a system of application, (5) molding operation authorization, (6) kiln drawing and dispatch, (7) mold requisition forms, (8) molding requisition form, (9) progress record card, (10) visible assessment of kiln position by use of the Tri-Colorgraph, and (11) planning. G.A.K.

Swedish domestic heating stove. G. W. SHEARER. *Engineering*, **157** [4087] 375 (1944).—A continental type of space-heating stove is designed for a normal consumption of 0.4 cu. ft. of wood per day. It is approximately 8 ft. 4 in. high, 3 ft. wide, and 2 ft. deep. The outside remains hot for 24 hr. The fire draft is required only while the fuel is actually burning, which takes less than an hour. Illustrated. G.A.K.

Up-to-date foundry. ANON. *Elec. Rev.*, **134** [3462] 436–40 (1944).—The electrical equipment of the molding, core-making, and castings-cleaning departments of a British steel foundry is described. All equipment is provided as far as possible with controls for safe operation. 8 photographs. M.R.

BOOKS AND SEPARATE PUBLICATIONS

American Patent System, an Economic Interpretation. W. B. BENNETT. Louisiana State Univ. Press, Baton Rouge, 1943. 259 pp. Price $3.00. Reviewed in *Mech. Eng.*, **66** [1] 76 (1944).—Written from an economic viewpoint, this book describes the U. S. patent system and discusses its uses and abuses. Many questions involving the patentee, the corporate concern, and the public are answered explicitly, with references to court decisions and the opinions of research workers and business men. F.G.H.

Development and Use of Certain Flotation Reagents. R. S. DEAN AND P. M. AMBROSE. *U. S. Bur. Mines Bull.*, No. 449, 89 pp. (1944). Supt. of Documents, Washington, D. C. Price 15¢.—The development and testing of a number of flotation reagents which were developed principally between 1935 and 1941 and the application of these reagents in the recovery of mineral values from ores are discussed. R.A.H.

Economic Opportunities for Producing Semi-Porcelain Dinnerware in North Carolina. Compiled by PHILIP SCHWARTZ. *North Carolina Dept. Conservation and Development, Div. Commerce and Industry, Bull.*, No. 44, 31 pp. (June, 1944).—A detailed and specific plan for the establishment of a ceramic industry in this state is presented. Estimated costs for the establishment of a plant in North Carolina are compared with costs in other places. The data are based on a $1,200,000 plant as the most feasible, although possibilities for smaller plants are explored. The bulletin includes information, maps, and tables on investments, plant-location possibilities, costs, fuel, power, taxes, raw materials, labor, markets, freight rates, and transportation.

Patent Law for Chemists, Engineers, and Students. C. H. BIESTERFELD. John Wiley & Sons, Inc., New York, 1943. 225 pp. Price $2.75. Reviewed in *Power*, **87** [11] 787a (1943); *Mech. Eng.*, **66** [1] 77 (1944).—The basic principles of the U. S. patent law are presented and illustrated by citation of and quotation from court decisions. The book is intended for persons without legal training who, in their daily work, are confronted at times with questions of patent law and practice. F.G.H.

Recovery of Sulfur Dioxide from Dilute Waste Gases by Chemical Regeneration of the Absorbent. H. FRASER JOHNSTONE AND ALAMJIT D. SINGH. *Univ. Illinois Eng. Expt. Sta. Bull.*, No. 324, 137 pp. (1940); *Chem. Abs.*, **35** 2301 (1941).—A commercially workable process for the recovery of SO_2 from waste gases is described. The waste gases are scrubbed with an aqueous solution of Na_2SO_3 and $NaHSO_3$. The fouled solution is regenerated by the addition of ZnO which precipitates $ZnSO_3 \cdot 2.5H_2O$ in a well-defined crystalline form that settles rapidly. The $ZnSO_3$ is dewatered and calcined to liberate the SO_2. When dealing with gases containing 0.3% SO_2, the oxidation is approximately 10% of the SO_2 absorbed. The SO_4 formed is removed by means of lime. The cost of the equipment for a plant treating 100,000 cu. ft. of gas per min. at 300°F. containing 0.3% SO_2 and recovering 21.7 tons of SO_2 per day would be approximately $140,000. This includes machinery for the liquefaction of the SO_2. The fixed charges and operating costs are approximately $15.40 per ton of SO_2. The advantages of this process are as follows: (1) The clear, neutral liquid gives a high rate of absorption and freedom from severe corrosion difficulties. (2) The precipitation of the scale-forming salts outside of the scrubber permits the use of cyclone spray scrubbers without danger of clogging of the nozzles. (3) There is no danger of loss of chemical by volatilization. (4) Pure SO_2 is produced. A detailed study of each step in the process and a flow sheet are given.

Suggestions on Care in the Use and Handling of Explosives in Coal Mines. LLOYD G. FITZGERALD. *U. S. Bur. Mines Information Circ.*, No. 7278, 7 pp. (May, 1944). Free.—F. stresses the importance of proper and adequate surface storage, care in transportation, and the use of permissible explosives instead of black blasting powder. R.A.H.

MEMBERS IN THE SERVICE

Each month the Society publishes a list of the members reported to have joined the service in the preceding month. This list now shows 286, but it is not complete. There are many others who have not sent in their addresses. We should have a complete list of every member, every former member, every ceramic graduate, and every ceramic student who is now in service.

If every member helps we can get an up-to-date list of our men in all branches of the service. We want to keep them in touch with what is going on in the industry and in The Society.

Will you send the list of your friends today?

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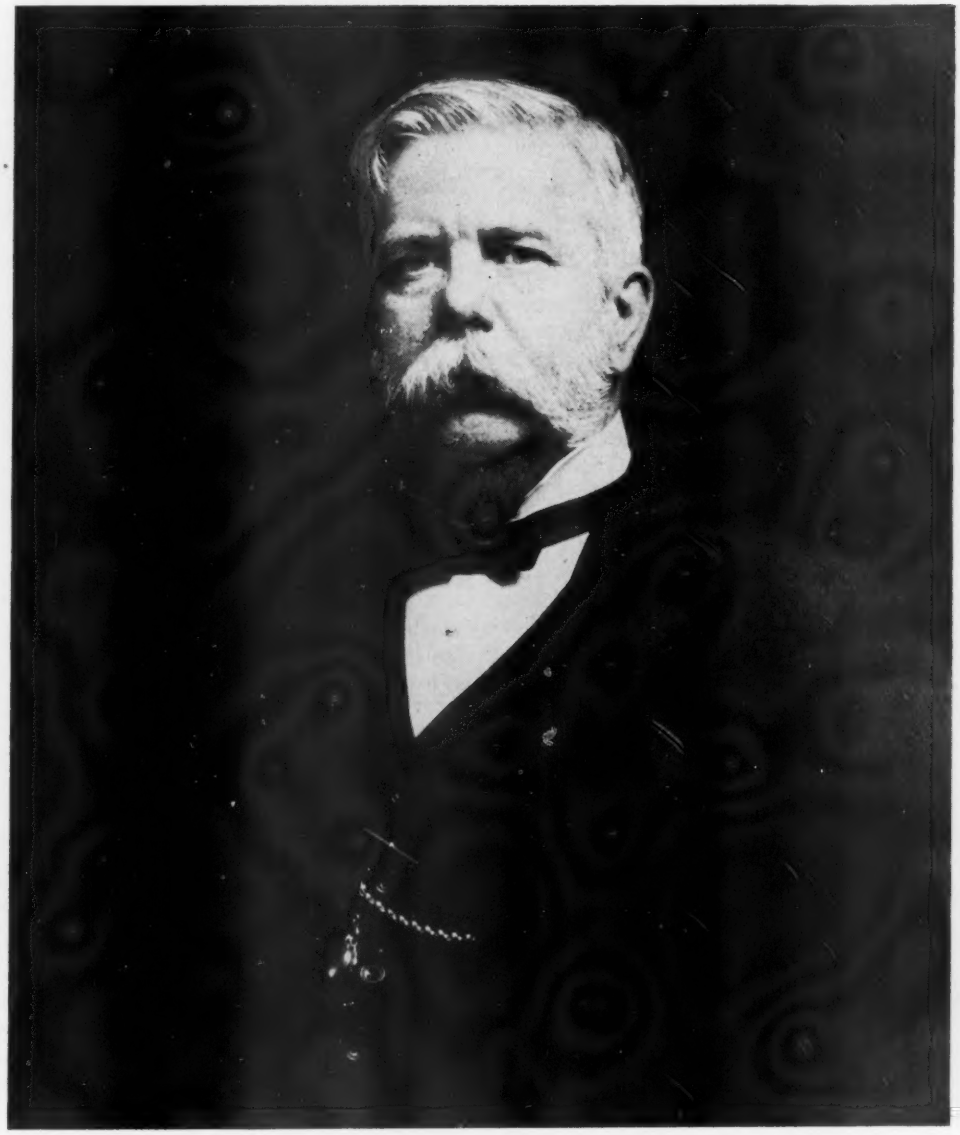
THE BULLETIN SECTION

Volume 23 **August 15, 1944** **Number 8**



GEORGE WESTINGHOUSE

GEORGE WESTINGHOUSE *

A Rugged Individual
A Creator of Many Useful Mechanical Things
An Organizer and Executive of Many Large Manufacturing Businesses

George Westinghouse became a great benefactor to mankind because he possessed inventive visions and the will and skill to make his visions materialize. He enjoyed the profits of his works. They were his, and his alone, to have and to hold, only and solely because they were made to benefit all mankind. His financial rewards were large, but they were used to perfect and to apply his inventions. He controlled himself and his works. He was a Rugged Individual.

"George Westinghouse, inventor, manufacturer, born Central Bridge, N. Y., October 6, 1846; son of George and Emeline (Vedder) W.; removed to Schenectady, 1856; educated in public and high schools and later, to sophomore year, Union College; honorary Ph.D., Union, 1890; Dr. Engineering, Königliche Technische Hochschule, Berlin, 1906; spent much time in father's machine shop, inventing at fifteen a rotary engine. Married Marguerite Erskine Walker, August 8, 1867. Member 12th N.G.S.N.Y. and 16th N. Y. Cav., Union Army, June, 1863–November, 1864; assistant engineer, U.S.N., December, 1864–August, 1865. Invented a device for replacing derailed steamcars, 1865; patented his invention of the air brake, 1868; applied pneumatic devices to switching and signaling, greatly increasing efficiency; also utilized electricity in this connection and became interested in development of electric machinery; acquired Gaulard & Gibbs patents, 1884, and introduced the alternating-current system of electric distribution for light and power; made many electric inventions; backed Tesla financially and with shop facilities in developing the induction motor, which made possible utilization of alternating current for power purposes; built the first ten great dynamos for Niagara, the dynamos for the elevated and subway roads in New York, and for the Metropolitan Railway, London. Devised a complete system for controlling natural gas and conveying it through pipe lines for long distances, thereby establishing the practicability of utilizing natural gas as fuel in homes, mills, and factories; took a foremost part in developing gas engines and in adapting steam turbines to electric driving. Founded works at Wilmerding, East Pittsburgh, Swissvale, and Trafford City, Pa.; Hamilton, Canada; Manchester and London, England; Le Havre, France; Hannover, Germany; Vienna, Austria; Vado, Italy; president of thirty corporations; trustee Equitable Life Assurance Soc. of U. S., June 10, 1905, to January, 1911. Decorated Legion of Honor, France, Royal Crown, Italy, and Leopold of Belgium; 2nd recipient of John Fritz medal. Honorary member, Am. Soc. Mech. Engrs. (pres., 1909–1910), Nat. Electric Light Assn. Died March 12, 1914."

* The factual statements are quotations from Who Was Who in America and from a book by Dr. Henry G. Prout, A Life of George Westinghouse, published by Charles Scribner's Sons, 1926, price $2.50, 376 pages.

"In 1856, George Westinghouse, Sr., established in Schenectady a shop for making agricultural machinery, mill machinery, and small steam engines . . . . Here George Westinghouse, Jr., passed a happy and busy boyhood. . . . In 1865 he was mustered out, a veteran of the Civil War, an officer, not yet nineteen years old. In September, he entered Union College, Schenectady, as a sophomore and three months later he went back to the shop. This was the end of his college career. . . .

"With the return of George Westinghouse to his father's shop the systematic work of his life began, not to be interrupted until his death forty-nine years later. The first patent issued to him was dated October 31, 1865, for a rotary steam engine. His work on this invention had begun two or three years before. . . . It is hardly necessary to say that the rotary engine never served any other purpose except that it may have affected his line of thought when he took up the steam turbine. . . . Westinghouse turned his rotary engine around and made an excellent water meter of it, and established another industry.

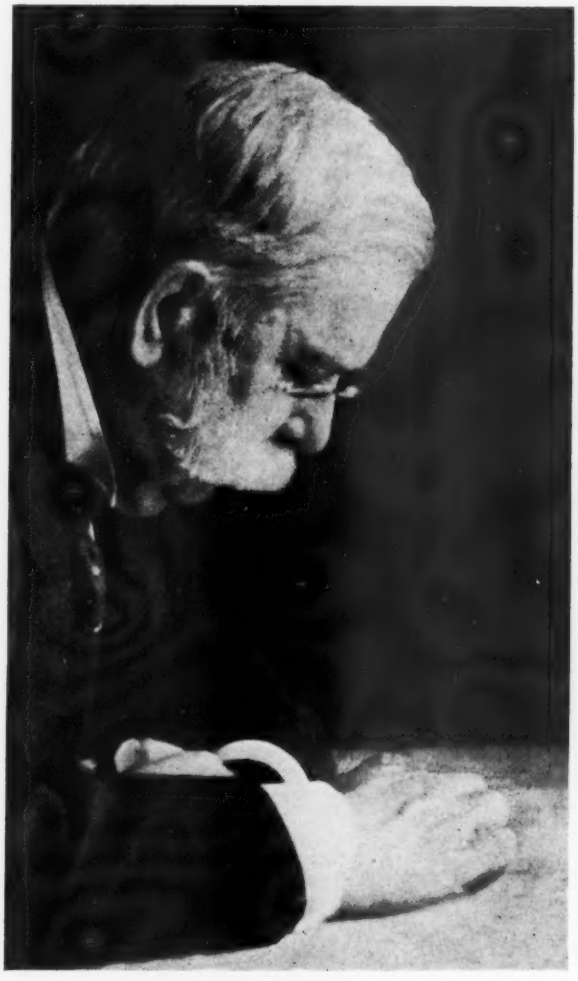
"Patents for a car replacer (for rerailing a car or engine) and for a railroad frog followed in 1867, 1868, and 1869, and these inventions were the foundation of a little business which seemed to a courageous young man to justify his marriage, which took place August 8, 1867, that is, before he was 21. . . .

"The foundation of the fame and fortune of George Westinghouse was the air brake. His first brake patent was issued April 13, 1869, he being then twenty-two and a half years old and still resident at Schenectady. It was reissued July 29, 1873, the inventor being then resident in Pittsburgh. In the years between, he had taken out twenty or more other patents on details of brake apparatus. . . .

"In a system of traffic control the relations of brakes and signals are close, and it was natural that the attention of Westinghouse should have been engaged by experiments, inventions, and practice that he saw developing in England and at home. As early as 1880, he acquired the American rights for English patents for interlocking switches and signals, and about the same time he bought certain American patents for the control of signals by track circuits. This was the foundation of another great industry. In this field Westinghouse made radical and highly important inventions, taking out numerous patents; but so many interests crowded upon him that, although his productive activity in signaling and interlocking was intense for a few years, the period was comparatively short. In one year, 1881, for instance, we find six patents in signaling and interlocking, one of them fundamental and revolutionary. In the same year, we find ten brake patents, one for a telephone switch and four in other arts—twenty-one patents in one year.

"The eleven years, 1880–1890, inclusive, brought many great things and were a period of prodigious activity.

In those years, the Westinghouse Brake Company, Limited (British), was started; the Union Switch & Signal Company was launched; the natural-gas episode began; the Philadelphia Company was formed; the Westinghouse Machine Company, the Westinghouse Electric Company, and the Westinghouse Electric Company, Limited (British), were started; the quick-action brake was produced, and thus one great crisis in the history of the air brake was met and triumphantly passed; and, perhaps, most important of all, Westinghouse revolutionized the electric art by his vision of the possibilities of the alternating current. . . .



George Westinghouse at work

"Here we only ask attention to the capacity for work, the boldness of conception, and the marvelous activity of creative imagination shown by Westinghouse from the beginning of his thirty-fourth year to the end of his forty-fourth. He did many things and great things in the twenty-four years that followed, but it is not an unreasonable suggestion that those eleven years were the years of his greatest creative power. In those years, he took out 134 patents, an average of over one patent a month, and he stimulated and directed the work of many other inventors.

(1944)

"Meanwhile he began and carried forward the financial and administrative organization of several companies, each one of which might have absorbed the energies of an ordinary man. His commercial and technical activities were felt in England and on the continent of Europe, and he established personal relations with philosophers, as well as with financial and business men, in many countries, and he was not yet forty-five. . . .

"As soon as the air brake was fairly under way in America, Westinghouse took it to England, and within ten years, that is, before he was thirty-five, he had organized companies and established shops in England, France, and Russia. He was famous and had a fortune sufficient for his moderate needs. We have taken the years 1880 and 1890 as possibly the period of Westinghouse's greatest creative power; but from what has just been said it is seen that the earlier decade ending with 1880 was rich in accomplishment, but it was confined mostly to the brake.

"After 1890, the years were crowded with great events. The crisis of 1893 almost swamped the Electric Company, but it emerged safely. The Company secured the contract for lighting the Columbian Exposition of 1893 at Chicago and made a brilliant technical success. This encouraged the development of the Company's incandescent lamp industry, and, what was much more important, it had a great influence on the direction and progress of the broader activities of Westinghouse and his engineers in the electrical field. It affected his thought and strengthened his position in the fierce struggle just opening up. In October, 1893, the Company took the contract for the first electric generators at Niagara Falls. This was a revolutionary event in the development of the electric art—romantic in conception and dramatic in execution. Many eminent men of various nations took part in the preliminary studies, and the foundations of some great reputations in electrical engineering were laid there. The world-meaning of the episode was that the question of the distribution and use of power through the agency of the alternating electric current was settled for all time. For Westinghouse this was a personal victory. . . .

"We may now turn back a few years. Late in 1883, Westinghouse became interested in the production and distribution of natural gas, and in 1884 the Philadelphia Company was formed to carry on that industry. In a few years, he took out thirty-eight gas patents, mostly for means of distribution and control, and he practically created a new art. These were among the 134 patents taken out in the years 1880–1890.

"It was a logical consequence of the natural-gas episode that Westinghouse should become interested in gas engines and in the manufacture of fuel gas. The Westinghouse Machine Company, founded by a younger brother, Henry Herman Westinghouse, and later taken over by George, developed and built gas engines of great size and in large numbers. They also built gas producers with some success, but the producer-gas enterprise was disappointing.

"About 1895, Westinghouse became interested in the steam turbine and this was an absorbing interest till his death. He continued incessantly to study, invent, and design, and his work profoundly influenced the development of the art. Eventually building turbines became much the largest part of the work of the Westinghouse

Machine Company, and, working with the Electric Company, they built many turbogenerator units for powerhouses, some of them of immense size. The marine side of the industry developed more slowly but it is now very important. The efficient speed of a propeller is low; the efficient speed of a turbine is high; consequently, great efficiency cannot be got from a direct-connected unit. Two possibilities were obvious, to modify the propeller or to interpose between the turbine and the propeller a reduction gear. Westinghouse made many ingenious, interesting, and costly propeller experiments which so far have been of no practical value. He took up simultaneously (about 1909) a reduction gear invented by Admiral Melville, U.S.N., and Mr. MacAlpine—a novel and highly interesting conception. This gear is now much used in turbine-driven ships of the Navy. . . .

"In the years from 1893 to 1907, the business of the numerous Westinghouse companies grew enormously. It is estimated that fifty thousand people were employed in production and distribution. The Westinghouse shops were scattered from San Francisco to St. Petersburg. In all these activities, Westinghouse had a constant part in executive conduct as well as in planning and administration—perhaps a part too close and constant for the best results. He was a prolific inventor, a bold and resourceful financier, a man of capacious imagination and foresight as to things to be done, and a powerful executive; but perhaps he was not a great administrator. . . . But in spite of an overburden of administrative care, his teeming mind went on through these later years inventing, contriving, and organizing.

"In 1907 came the tragedy of Westinghouse's life. The great panic caused the failure and receivership of the Electric Company, the Machine Company, and some minor companies, but did not affect the Air Brake Company or the Union Switch & Signal Company. A reorganization was eventually brought about, based upon a brilliant project devised by Westinghouse, but the actual control of the Electric Company passed out of his hands, and in less than four years he ceased to have any official relations with the Company. . . .

"Late in 1913, the magnificent structure gave way. An organic disease of the heart developed. The quizzical humor still lived, the inventive spirit still was active, but the body slowly faded away, and on March 12, 1914, he died."

George Westinghouse lived only sixty-seven years, seven months, and six days, but what prodigious creations and extended manufacturing enterprises were his in these few years! A Rugged Individual, indeed!

CLARENCE SAMUEL ROSS

Orton Fellow Lecturer for 1945

Clarence Samuel Ross, Chief of the Section of Petrology in the United States Geological Survey, Washington, D. C., will be the Edward Orton, Jr., Fellow Lecturer for 1945.

Dr. Ross's special interest in the clay minerals dates back about twenty years. Throughout this period, he has directed a large part of his energies toward unraveling the complex interrelations of the various clay minerals. It was Dr. Ross who first discovered, by optical studies, that $Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$ was represented by the three clay minerals kaolinite, dickite, and nacrite. That conclusion was later confirmed by the X-ray studies of Paul F. Kerr, and Dr. Ross and Dr. Kerr afterward cooperated in clarifying the relations between two other clay minerals, halloysite and allophane. In 1926, Dr. Ross and Mr. Shannon published their first paper dealing with the minerals of the montmorillonite and hydromica groups in the *Journal of The American Ceramic Society* (see Bibliography, first publication No. 4). Since that time, Dr. Ross has been working continually on the minerals in these groups and, in cooperation with Sterling B. Hendricks of the U. S. Department of Agriculture, has prepared a comprehensive memoir on them which is soon to be published. In all, Dr. Ross has published sixteen papers dealing primarily with clay and clay minerals.

He has also published many papers on other aspects of mineralogy, petrology, and geology, which are included in the accompanying list of publications. This list, however, falls short of giving a complete idea of Dr. Ross's contributions to science. As the leading authority on petrology and petrography in the United States Geological Survey, he has for many years had a hand, sometimes only as a critic but more commonly as a direct contributor, in practically all of the Survey's reports on mining districts and on igneous and sedimentary petrology. American geologists and mineralogists, in and out of the Survey, have for a long time turned to Dr. Ross for help in dealing with any problem that relates to the clay minerals.

Dr. Ross was born in Eldora, Iowa, September 20, 1880, the son of James S. and Martha Daniels Ross. He attended the Kansas State Agricultural College, Manhattan, Kans., for one year (1907–1908) and in 1913 received the A.B. degree from the University of Illinois, Urbana, Ill. He later received the A.M. and Ph.D. degrees from the same school (1915 and 1920).

He has served as chairman of the Committee for Investigation of Clay Minerals of the National Research Council (1928–1933) and as a representative of the Mineral Society of America on the National Research Council (1931–1933). He is a member of the Geological Society of America (vice-president, 1936), Mineralogical Society of America (president, 1935), Washington (D. C.) Academy of Sciences (vice-president, 1943), Geological Society of Washington (president, 1942), Washington Petrologists Club, Society of Economic Geologists, and the Society of Economic Paleontologists and Mineralogists.

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Clarence Samuel Ross

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THOUGH MISS ECKARDT IS MARRIED SHE YET IS MARIE* TO HER HOST OF SOCIETY MEMBER FRIENDS

Mrs. Eugene Mulvane

The single-ring ceremony performed by candlelight at the white satin-covered altar of the Little Chapel of the First Community Church, Columbus, Ohio, by Dr. Roy Burkhart, united in marriage Miss Marie Eckardt, daughter of Mr. and Mrs. Charles A. Eckardt, and Dr. Eugene L. Mulvane, son of Mr. and Mrs. J. R. Mulvane, June 15 at 7:30 P.M. The church was decorated with baskets of spring flowers.

The tightly fitted bodice of the bride's ivory duchesse satin gown was fashioned with a deep yoke of marquisette edged with seed pearl embroidery. The long fitted sleeves ending in points over the hands were also trimmed with seed pearl embroidery and her extremely full skirt fell in a circular train. A coronet of princess lace held the fingertip veil of imported illusion. The bride's white Bible, a gift of the bridegroom, was topped with an orchid and a cascade of white ribbons.

Following the ceremony, a reception was held in the chapel.

Having returned from a short wedding trip, Dr. and Mrs. Mulvane are now making their home at 1318 Virginia Ave., Columbus, Ohio.

Mrs. Mulvane has been associated with The American Ceramic Society as assistant secretary and advertising manager. Dr. Mulvane is a practicing osteopath with offices in Columbus.

For a while, Mrs. Mulvane will continue her services with The Society. No longer will she sign off with "M.E." It is now "M.M.," and we hope she will be with us for a long while to come.

O.C.I.A. AUTUMN MEETING

The annual autumn meeting of the Ohio Ceramic Industries Association will be held October 20 and 21, 1944, in Columbus, Ohio.

AUTUMN MEETINGS

Glass Division: Hotel Schenley and Longue Vue Country Club, Pittsburgh, Pa., September 13 and 14.
White Wares and Materials and Equipment Divisions: Hotel Summit, Uniontown, Pa., September 15 and 16.
Upstate New York Section: Sherwood Hotel, Hornell, N. Y., October 27.
Ceramic Association of New York: New York State College of Ceramics, Alfred, N. Y., October 28.

BE YE PREPARED FOR THE MORROW

Machine Will Replace Muscle
Streamlining Processes Will Reduce Labor
Automatic Machine Processing Will Make Better Products
Home, Factory, and Office Housings Will
Require New Designs and New Products
Health and Comfort Will Be Better Served
More Rigid Control Must Be Maintained
Researches Must Be Made
There Must Be a More Vigorous Searching of
Fundamental Sciences

Synergize With Your Fellow Ceramists to Meet These Demands in This Growing

AMERICAN CERAMIC SOCIETY, INC.

PAID MEMBERSHIP AND SUBSCRIPTION RECORD

Date of Record	Members Paid		Deferred	Subscriptions	Monthly Sales	Total Circulation
	Personal	Corporation				
July 21, 1943	1968	290	11	455	220	2944
January 21, 1944	2110	323	4	531	220	3188
February 21, 1944	2147	330	4	540	220	3241
March 21, 1944	1844	323	4	523	220	2914
April 21, 1944	1996	344	3	560	220	3123
May 21, 1944	2061	361	4	570	220	3216
June 21, 1944	2125	366	3	576	220	3290
July 21, 1944	2155	367	3	589	220	3334
12-month % increase	9.5	26.5		29.4		

NEW MEMBERS IN JULY

Corporation

DIAMOND GLASS CO., J. R. Hanson (voter), Royersford, Pa.

Personal

FISHER, JOSEPH R., Bell Telephone Laboratories, Murray Hill, N. J.; member, technical staff.

GLEUCK, M. A., Research Laboratory, 35th and Olive Sts., Kansas City, Mo.

HEASLET, JAMES, JR., "Blairlea," Stobswood, Morpeth, Northumberland, England; works manager, Burn Fireclay Co., Ltd.

KIEHL, HARRY R., 223 Chemung St., Corning, N. Y.; physicist, Corning Glass Works.

*MACKASEK, EDWARD, 1010 Vermont Ave., N. W., Washington 5, D. C.; managing director, Porcelain Enamel Institute.

MARTIN, RANDOLPH M., Box 951, Nacogdoches, Texas; Bennett-Clark Co.

OESTERLE, ROBERT A., 2427 W. Main, Belleville, Ill.; ceramist, Roesch Enamel Range Co.

SHAND, ERROL B., 168 Pine St., Corning, N. Y.; Corning Glass Works.

SMITH, WENDELL O., Corning Glass Works, Corning, N. Y.; technical glass supervisor.

STRINGER, FRED W., 3765 Dover Place, Los Angeles, Calif.; manager, Don Rey Pottery.

TANCOUS, LT. ERNEST, Bluethenthal Field, Wilmington, N. C.

TINSLEY, STANLEY G., British Titan Products Co., Ltd., Billingham, County Durham, England; development manager. (Membership formerly in name of George F. New.)

VIDAL, HÉCTOR GUZMÁN, Box 383, Fajardo, Puerto Rico; chemical engineer.

*WILLIAMS, GEORGE F., 130 Platt St., Painted Post, N. Y.; Corning Glass Works.

WILLSON, HERBERT S., 256 Bridge St., Corning, N. Y.; Corning Glass Works.

Student

Pennsylvania State College: WILLIAM W. COLBERT.

* Indicates former member of The Society rejoining.

MEMBERSHIP WORKERS' RECORD

CORPORATION: R. R. Shively 1.

PERSONAL: C. A. Bradley 1, R. M. Campbell 1, C. H. Greene 1, R. K. Hursh 1, A. L. Johnson 1, J. T. Littleton 1, E. L. Maxson 1, F. K. Pence 1, Norman Plummer 1, M. D. Rigterink 1, Office 5.

STUDENT: W. Weyl 1.

GRAND TOTAL: 17.

ROSTER CHANGES IN JULY*

BECK, J. HOWARD, 1800 Commonwealth Ave., Brighton, Mass. (Dorchester, Mass.)

CURTIS, WESLEY E., Box 503, Woods Hole, Mass. (Alfred, N. Y.)

FULCHER, GORDON S., 48 Elm St., Springfield, Vt. (Washington, D. C.)

GEIGER, JOSEPH S., 681 76th St., Niagara Falls, N. Y. (Anderson, Ind.)

GINGOLD, JACOB, General Ceramics & Steatite Corp., Crows Mill Rd., Keasbey, N. J. (Plainfield, N. J.)

HAGERMAN, ROBERT S., Fort Sill, Okla. (Fort Moultrie, S. C.)

NOVY, ANTON R., 5204 West 23rd Place, Cicero, Ill. (Berwyn, Ill.)

OSTRANDER, VAN R., 10 Judson Ave., Ardsley, N. Y. (Yonkers, N. Y.)

PITTMAN, JACK, Box 986, Lewistown, Mont. (Seattle, Wash.)

REISS, MAX S., A.S.N. 35085762, Camp Sibert, Ala. (Bellaire, Ohio)

ROSE, CHARLES R., 104 Fairway Blvd., Apt. D, Columbus 9, Ohio (Santa Monica, Calif.)

ROSS, DONALD W., 6926 Pineway, Hyattsville, Md. (Daisy, Tenn.)

THOMAS, EVERETT A., 28 Montclair St., Buffalo 15, N. Y. (Niagara Falls, N. Y.)

VINCENT, GEORGE L., 159 Oaklyn Terrace, Trenton, N. J. (Milwaukee, Wis.)

WAGNER, HAROLD F., Roseland, Neb. (Belmar, N. J.)

WHITWOOD, ROBERT A., 44 E. Union St., Hamburg, N. Y. (Blasdell, N. Y.)

* Address in parentheses is former address.

MEMBERS IN SERVICE*

The following members of this Society are in fighting units of war service. There are several in service in Washington not included in this Service Roster. This list, which was begun September, 1942, and added to each succeeding month, is probably not complete, and we would appreciate information on other members.

(285) ROBERT S. GREEN, A. P. Green Fire Brick Co., Mexico, Mo.
(286) RICHARD P. KELTING, Plastic Lights, Inc., Toledo, Ohio.
(287) BERT M. LYNN, Davidson Brick Co., Los Angeles, Calif.
(288) MAX S. REISS, Bellaire Enamel Co., Bellaire, Ohio.
(289) GILBERT C. ROBINSON, Church St., Cooleemee, N. C.
(290) EVERETT THOMAS, Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

* These are in addition to the lists published monthly, beginning with the September, 1942, *Bulletin*, with the exception of the June, 1943, issue.

F. W. ADAMS WITH CLARK THREAD COMPANY

Frederick W. Adams has been appointed director of research of the Clark Thread Co., Newark, N. J., and associated companies and will make his headquarters at the New York offices of the Company. He will be responsible for the development of plans for the coordination and expansion of research within this organization. Dr. Adams was associated formerly with the Pittsburgh Plate Glass Co., Pittsburgh, Pa., in their product development department.

A biographical sketch and photograph of Dr. Adams appeared in the January, 1944, *Bulletin*, pp. 16–17.

NECROLOGY

LT. SAMUEL B. MEYER, JR.

It is with extreme regret that we announce the death of Lt. Samuel B. Meyer, Jr., son of S. B. Meyer, president of the Glenshaw Glass Co., Inc., Glenshaw, Pa. Lt. Meyer was killed in a combat training flight July 2, 1944, near Woodward, Okla., with the entire crew of eleven men.

Lt. Samuel B. Meyer, Jr.

Enlisting in the Army Air Force September 1, 1942, Lt. Meyer was called into active service February 18, 1943. He attended Yale University for his training as maintenance engineer in the AAFTTC and was graduated July 18, 1943. At the same time, he received his commission as a second lieutenant. He subsequently trained at Boeing Aircraft, Seattle, Wash. (on B-29 planes); Salina, Kans.; Flight Engineers School, Lowry Field, Denver, Colo.; and Clovis, N. Mex. (B-29 combat phase).

Lieutenant Meyer was born March 11, 1918. He was graduated from the University of Pittsburgh with the B.S. degree in 1939 and received the M.S. degree in ceramic engineering from the Pennsylvania State College in February, 1942. He was employed by the Glenshaw Glass Co., Inc., before entering service.

He was a member of Pi Kappa Alpha fraternity and the English Lutheran Church, Sharpsburg, Pa. He had been a member of The American Ceramic Society since 1943.

Besides his parents, he is survived by two sisters, Jean and Grace, and a brother, Corporal James E., who is on active duty with the Army Air Corps in Italy.

WILLIAM BURGESS*

Following a long illness, William Burgess passed away at his home in Todmorden, Ontario, Friday, May 26, 1944, at the age of seventy-five. He left to mourn his loss his wife, Frances Chard Burgess, and three sons, William, Jr., Richard, and Clarence. The funeral service was held in Don Mills United Church May 30, and interment took place in St. John's cemetery. The church was unable to hold the crowd of old friends who wished to pay him their respects. The floral offerings were many and beautiful.

William Burgess

The late Mr. Burgess, known as Bill to his wide circle of friends, was connected with the Don Valley Brick Works practically all his life and was one of Canada's outstanding brick and tile makers. He was millwright of the Don Valley Brick Works and the Don Valley Paper Mills during four or five years of the Taylor Brothers' ownership.

When Robert Davies took over these properties, Bill served as assistant superintendent to John Millar, who had been superintendent of the brick plant for eighteen or nineteen years before he left to conduct brick plants in British Columbia and Alberta.

Following the departure of John Millar, Bill was appointed superintendent in 1909. The choice was a happy one, for Bill was an expert on manufacturing and was always visiting other plants on the continent and investi-

* Reprinted from *Clay Products News*, **17** [6] 4 (1944).

gated any new machinery to secure the best equipment and methods available for his plant.

Thus the Don Valley Brick Works became one of the best-known and most progressive brick plants on the continent. Bill was president of the Canadian Association in 1919 and 1920 and a member of the American Association. He was a regular attendant at the conventions.

Bill was greatly interested in education and was first elected to the East York Board of Education in 1899. He was a member of the board for over forty years and served as chairman of the East York High School Board. Later he was appointed secretary of the Board and held that position until illness forced him to resign about six years ago. One of the finest schools in the province, erected at Todmorden, is called the William Burgess School. Two or three years ago, the Board of Education presented Mr. Burgess with an oil painting in appreciation of his work, and it hangs in the William Burgess School library. He was presented with an illuminated address at the conclusion of forty years of service on the Board.

He served on the Technical Committee of the Canadian Ceramic Society and was one of the four trustees who arranged for the ceramic engineering course at the University of Toronto, Ryland H. New, chairman; William Burgess, Harold Dingledine, and Gordon C. Keith, secretary-treasurer.

At conventions he was always ready to share his knowledge and contributed many valuable and helpful papers. He will long be remembered as one who contributed greatly to the educational needs of young boys and girls of his community and to the education of young men interested in securing an education in ceramic engineering.

As a tried and trusted friend he will be greatly missed by the editor and many in the brick and tile industry of the United States and Canada.

Mr. Burgess had been a member of The American Ceramic Society since 1923.

DONALD ALONZO MOULTON

Donald Alonzo Moulton, a Fellow of The American Ceramic Society, died suddenly of a heart attack May 27, 1944.

Joining The Society in 1908, Mr. Moulton had been active in the Structural Clay Products Division, having served as secretary of the Division (1934–1935), member of Nominating Committee A and chairman of the Data Committee (1935–1936), vice-chairman (1936–1937), and chairman (1937–1938). He had been more recently affiliated with the Refractories Division.

He was also a charter member of the Institute of Ceramic Engineers and an honorary member of Keramos.

Biography

Mr. Moulton was born in Ironton, Ohio, March 31, 1885. After graduating from the Ironton High School, he entered the Ohio State University, Columbus, Ohio, and was graduated with an engineering degree in ceramics in 1908.

After a year as state inspector of cement (Osborn Engineering Co.), Cleveland, Ohio, he became inspector of stoneware at the Bloomingdale Stoneware Co., Bloomingdale, Ind. He then went with the Southern Clay Mfg. Company to take charge of firing at their Warrior, Ala., plant. In 1913, he built the Credit Forks Clay Products Company plant at Credit Forks, Ontario, Canada.

When World War I interrupted the building brick industry in Canada, Mr. Moulton went to Firebrick, Ky., as superintendent of the Peebles Paving Brick Company's plant located there. Later he was research engineer with the McLain Fire Brick Co., Wellsville, Ohio, and the A. P. Green Fire Brick Co., Mexico, Mo.

In 1921, he became a member of the faculty of Iowa State College, Ames, Iowa, where he taught ceramic engineering for fifteen years.

For one year, Mr. Moulton was assistant to the president of the Standard Brick & Tile Co., Evansville, Ind. He was sales and service engineer in the Clay Machinery Division of the Lancaster Iron Works, Lancaster, Pa., for several years and also did consulting work for the Montreal Terra Cotta Lumber Co., Lakeside, Quebec; the Citadel Brick Co., Quebec; the Standard Brick & Tile Co., Pueblo, Colo.; and the Alsey Brick & Tile Co., Alsey, Ill. He had been with the National Fireproofing Corp., Pittsburgh, Pa., in charge of research at the laboratory of their East Canton plant for the past two years.

Mr. Moulton leaves his widow, Mrs. Shirley C. Moulton, two brothers, and one sister.

He was a Mason and a member of the First Presbyterian Church in Canton, Ohio.

Donald Alonzo Moulton

Publications

(1) "Oil-Fired Furnace for the Plant Laboratory," *Jour. Amer. Ceram. Soc.*, **5** [10] 713–20 (1922).

(2) "Note on Ladle Brick," *ibid.*, [11] 823–25.

(3) (With P. E. Cox) "A New Raw Material for Ceramic Uses," *ibid.*, **6** [8] 937–39 (1923).

(4) "Progress Report on Research of Paving Brick from Iowa Shales," *ibid.*, **8** [11] 694–701 (1925).

(5) "Better Colors for Clay Products," *Brick & Clay Record*, **66** [11] 824 (1925).

(6) "Refractory Material Used as Mortar for Laying Up Refractories," *Trans. Ceram. Soc.* [Eng.], **27** [4] 329–33 (1927–28); *Refrac. Jour.*, **3** [33] 846–47 (1928).

(7) "New Use for Old Refractory Material," *Clay-Worker*, **93** [6] 413 (1930).

(8) "High-Temperature Furnace Using Graphite Crucible," *Brick & Clay Record*, **83** [4] 132 (1933).

(9) "Special Drier for Clay Tile," *ibid.*, **84** [1] 14–16 (1934).

(10) "Grinding Roll vs. Dry Pans," *ibid.*, [2] 50–51.

ACTIVITIES OF THE SOCIETY

INSTITUTE OF CERAMIC ENGINEERS

Executive Committee, 1944–1945

President: M. F. BEECHER, Norton Co., Worcester, Mass.
Vice-President: T. A. KLINEFELTER, U. S. Bureau of Mines, Tuscaloosa, Ala.
Secretary: R. S. BRADLEY, A. P. Green Fire Brick Co., Mexico, Mo.
Past-President: H. B. DUBOIS, Consolidated Feldspar Corp., Trenton, N. J.
Trustee Representative: H. M. KRANER, Bethlehem Steel Co., Bethlehem, Pa.

INSTITUTE WAIVES DUES OF MEMBERS IN SERVICE

By action of the Executive Committee of the Institute of Ceramic Engineers at the April 1 meeting at Pittsburgh, Pa., dues for the Institute will be waived for members during the time they are in active military service. Upon return to civilian life, they will be reinstated automatically as members of the Institute merely by payment of the current dues.

This applies only to dues for the Institute and not to dues for The American Ceramic Society.

COMMITTEE CHAIRMEN APPOINTED FOR 1944–1945

Committee on Rules: PAUL G. HEROLD, Missouri School of Mines, Rolla, Mo.
Committee on Engineers' Council for Professional Development: A. F. GREAVES-WALKER, War Production Board, Metals and Minerals Branch, Washington, D. C.
Committee on Membership and Examinations: A. S. WATTS, Dept. of Ceramic Engineering, Ohio State University, Columbus, Ohio.
Committee on State Boards of Engineering Examiners: A. F. GREAVES-WALKER.
Committee on Education: JAMES R. BEAM, Universal Sanitary Mfg. Co., New Castle, Pa.
Committee on Professional Status and Development: C. M. DODD, Dept. of Ceramic Engineering, Iowa State College, Ames, Iowa.
Committee on Classification and Nomenclature: G. H. SPENCER-STRONG, Pemco Corp., Baltimore, Md.
Committee on Engineering Practice: E. P. MCNAMARA, Dept. of Ceramics, Rutgers University, New Brunswick, N. J.
Committee on Nominations: J. L. CARRUTHERS, Dept. of Ceramic Engineering, Ohio State University, Columbus, Ohio.

CERAMIC EDUCATIONAL COUNCIL

REPORT OF COMMITTEE ON PHYSICAL CHEMISTRY

Many students in ceramics have objected to their required study of physical chemistry on the basis that they see no practical application of the subject. They do not realize that applications of physical chemistry are involved in many common ceramic processes which deal with, for example, the properties of colloids, the drying and firing processes, the combustion of fuels, and the study of high-temperature equilibria.

In our opinion, the subject of physical chemistry should consist of a two-semester course, meeting three times a week, with a supplementary laboratory course if time permits. The first semester should be devoted to the study of a suitable textbook on elementary physical chemistry, whereas the second semester should consist of a course in heat and thermodynamics.

As the subject matter of an elementary textbook on physical chemistry is covered in one semester, some topics must be considered in a brief manner. We believe that the fundamental laws and theories of physical chemistry (such as the kinetic theory of gases, chemical equilibria, crystal chemistry, and atomic structure) should be stressed in preference to the usual detailed study of dilute solutions.

Concerning the second-semester course in heat and thermodynamics, we prefer the approach of the physicist to that of the chemist. For our work, we consider the text of J. K. Roberts to be satisfactory if undue stress is not placed on applications to mechanical engineering.

The function of the teacher of physical chemistry should be to introduce the subject to the student and provide a good foundation in this branch of science. The burden of teaching applications of physical chemistry to ceramics should rest with the ceramic engineering staff.

—A. E. BADGER, *Chairman*, AND C. G. HARMAN

ANNUAL MEETING OF THE FELLOWS

The annual meeting of the Fellows was held in Pittsburgh, Pa., at 10:15 A.M., April 2, 1944. Robert B. Sosman, Dean, presided, and R. M. King was present as Secretary-Treasurer.

No corrections were offered to the minutes of the preceding meeting as published in the September, 1943, *Bulletin*, p. 315. Dean Sosman then read his report for the year (see the July, 1944, *Bulletin*, p. 231). The Secretary-Treasurer reported that the fund standing to the credit of the Fellows was $1870.79.

No appointment had been made to the Committee on Honorary Membership, as the list of ten honorary members was completely filled. The Dean inserted in the record the names of the honorary members, as such a list is not now available in *The Bulletin*. The honorary members are as follows:

A. H. M. ANDREASEN, Copenhagen K., Denmark.
A. V. BLEININGER, Newell, W. Va.
FREDERICK CARDER, Corning, N. Y.
ARTHUR L. DAY, Bethesda, Md.
A. S. W. ODELBERG, Djursholm, Sweden.
ROSS C. PURDY, Columbus, Ohio.
REINHOLD RIEKE, Berlin, Germany.
HEINRICH RIES, Ithaca, N. Y.
CHARLES W. THOMAS, Old Swinford, Stourbridge, England.
W. E. S. TURNER, Sheffield, England.

To accommodate M. F. Beecher, who had to leave at an early hour, he was asked to present informally the report of The Society's Committee on Classification and Nomenclature, which was initiated in 1943. There was considerable discussion of the program of the Committee by Louis Navias, J. C. Hostetter, A. S. Watts, H. T. Coss, W. K. McAfee, S. J. McDowell, Howells Fréchette, A. F. Greaves-Walker, G. E. Seil, M. E. Holmes, L. E. Barringer, A. I. Andrews, and C. R. Amberg. The discussion centered principally about two points: (1) the definition of "ce-

ramics," and (2) a proposal by L. E. Barringer that The Society publish a handbook of standards, including definitions and classifications. There was general agreement that the Fellows recommend to the Trustees (1) that the definitions adopted by the Committee be published promptly as tentative definitions, subject to criticism and amendment, and (2) that the cooperation of The Society's Committee on Public Relations be enlisted in giving the widest possible circulation to the definitions finally adopted. With respect to a Society handbook, although there was no formal vote on the subject, there was favorable expression of willingness on the part of the Fellows to assist the Trustees in preparing such a publication and to support it financially.

L. E. Barringer then presented a report from a special committee of the Fellows on Relations of the Fellowship to The Society, consisting of himself as Chairman, J. C. Hostetter, and W. K. McAfee. The Committee approved of changes in the Constitution and By-Laws of The Society discontinuing the present autonomous organization of the Fellows, but recommended a further consideration of disposal of the Fellowship funds. The report was discussed by Louis Navias, J. W. Whittemore, W. K. McAfee, D. G. Bennett, S. J. McDowell, C. R. Amberg, G. E. Seil, A. S. Watts, and Howells Fréchette. The meeting voted to bring the subject of discontinuance of the autonomous organization to the attention of the entire membership of the Fellows by mail and ask them to express their opinions. If a majority is favorable to discontinuance, the officers of the Fellowship are authorized to prepare definite proposals for the Board of Trustees, putting the decision into effect before or at the next Annual Meeting of The Society. The motion was amended to provide that the arguments for and against the proposals presented in the meeting were to be briefly stated in the circular to the membership.

The meeting then proceeded to its previously assigned function of hearing and discussing reports from the technical committees and representatives of The Society, as authorized by the Board of Trustees. Because of lack of time, many of the reports could be presented only by title and abstract.

In connection with the report of the Committee on Patents (F. B. Flick, Chairman), R. E. Birch spoke of a proposal made during the year that The Society acquire a few of the Patent Office models which are now being disposed of by that Office, particularly those illustrating the more important inventions in ceramics. Mr. Birch himself had purchased two of these patent models and exhibited the one illustrating the continuous tunnel patent of 1867. One hundred dollars of the Fellowship funds had been made available for the purchase of some models for the Secretary's museum, but the sum had been considered inadequate for the purpose and no models had been purchased.

J. W. Whittemore outlined the contents of his assembled report of the Committee on Standards, and individual details were then discussed, particularly personnel of The Society's representation. The meeting voted to recommend to the Board of Trustees that if the Enamel Division approves certain standards discussed at the meeting of the Division, these standards be adopted and published by the Board of Trustees as standards of The Society itself. (See p. 271, this issue.)

The meeting also recommended to the Trustees that they take steps to rationalize the present standards setup of The Society, particularly with reference to the relation between standards adopted by a Division and standards accepted and approved by The Society as a whole.

Brief reports were then received from The Society's representatives in various other organizations, particularly the American Society for Testing Materials and the American Standards Association. It was reported that The Society's nominee to A.S.T.M. Committee C–5 on Fire Tests of Materials and Construction was considered ineligible because of his association with a producer and that The Society should be represented by someone from the "general interest" group. No nomination was offered in the meeting but the President subsequently authorized the Dean to make a nomination as the Committee requested prompt action for the sake of a Committee ballot; J. L. Carruthers was named. A. W. Gauger was nominated as representative on A.S.T.M. Committee D–3 on Gaseous Fuels. H. H. Blau was nominated as The Society's representative on a joint committee with the Illuminating Engineering Society and the Luminous Glassware Guild.

As it had been anticipated that the autonomous organization would be discontinued, no nominations had been called for for the office of Dean of the Fellows for the term 1944–1947. The meeting voted to continue the existing officers until the form of government of the organization had been finally determined.

The meeting adjourned at 1:00 P.M.

CHANGES IN DIVISION RULES

GLASS DIVISION

The following amendments to the Glass Division Rules have been proposed by the Rules Committee and will be voted on by letter ballot. See *Bull. Amer. Ceram. Soc.*, **18** [1] 22–23; [6] 216 (1939) and **22** [6] 194 (1943) for Division Rules and other changes and adjustments.

Article GR VII. Nominations and Elections

Change to read:

(1) The Nominating Committee of this Division shall consist of three members appointed by the Chairman. This Division Nominating Committee shall name one person for each office: Chairman, Vice-Chairman, and Secretary. The Committee shall submit these nominations to the Chairman of the Division at least ninety (90) days prior to the date of the next Annual Meeting of THE SOCIETY.

(2) Ten (10) or more members of this Division may make nominations for officers or for Trustee representative by submitting a formal petition to the Chairman of the Division at least ninety (90) days prior to the Annual Meeting.

(3) The Chairman of the Division shall transmit all nominations to the General Secretary of THE SOCIETY at least seventy (70) days prior to the opening date of the next Annual Meeting for inclusion on the combined ballot for SOCIETY elections. The distribution, return, and counting of the ballots shall be governed by the Rules of THE SOCIETY.

(4) (*a*) The Division Nominating Committee shall also, when properly notified, nominate a candidate for the office of Trustee representative of this Division, and shall submit his name, together with his acceptance in writing, to the Chairman of the Division, at least ninety (90) days prior to the Annual Meeting of THE SOCIETY at which the three-year term of the Trustee representative expires, or when an interim vacancy is to be filled.

(*b*) The Chairman of the Division shall, at least seventy (70) days before the opening date of the next Annual Meeting of THE SOCIETY, forward to the General Secretary of THE SOCIETY the names of the nominees for Trustee representative made by the Executive Nominating Committee as well as any nominees by proper petition as provided in Section (2) hereof. The nominees of the Executive Nominating Committee shall be so designated.

(5) (*b*) In the event of election as President, Vice-President, or Treasurer of THE SOCIETY or in the event of refusal to act, incapacity to act, or the resignation of the Trustee representative of this Division, a successor shall be appointed by the Division Chairman to serve until the next Annual Meeting of THE SOCIETY, at which time a Trustee representative shall be elected to fill the unexpired term, if any, as provided in Sections (3) and (4) hereof.

WHITE WARES DIVISION

The Rules Committee offered the following changes in the Rules of the White Wares Division as given in *Bull. Amer. Ceram. Soc.*, **17** [10] 402–403 (1938). They were adopted by letter ballot.

Article WR IV. Government

(2) Insert the word "Vice-Chairman" after the word "Chairman."

Article WR VI. Officers

Insert the following section:

(2) The Vice-Chairman shall assist the Chairman and succeed to the powers and duties of the Chairman in the event of the refusal or incapacity of the Chairman to act.

(3) Delete the sentence, "The Secretary shall perform the duties of the Chairman in his absence."

Article WR VII. Nominations and Elections

Change all sections to read as follows:

(1) The voting members of the Division in meeting assembled shall elect, by secret ballot, an executive Nominating Committee of the Division, consisting of the three (3) members receiving the highest numbers of votes.

(2) Additional nominations for Division officers, other than those nominations presented by the Executive Nominating Committee of the Division, may be made by petition signed by twenty (20) members of the White Wares Division and sent to the Chairman of the Division at least seventy-five (75) days before the Annual Meeting, who shall immediately forward the names of the various nominations to the General Secretary of THE SOCIETY to be added to the Division ballot.

(3) It shall be the duty of the Executive Nominating Committee to make one nomination for Chairman, one nomination for Vice-Chairman, and two for Secretary, and these nominations from the Division shall be mailed to the Chairman of the Division at least one hundred and twenty (120) days prior to the Annual Meeting of THE SOCIETY, accompanied by their acceptance of such nomination in writing.

(4) (*a*) The Division Nominating Committee shall nominate two candidates for the office of Trustee representative of this Division and shall certify their names, together with their acceptance in writing, to the Chairman of the Division at least one hundred and twenty (120) days prior to the Annual Meeting of THE SOCIETY at which the triennial term of the Trustee representative expires.

(*b*) The Chairman of the Division shall transmit the nominations to the General Secretary of THE SOCIETY at least seventy (70) days before the opening date of the next Annual Meeting of THE SOCIETY.

(*c*) Delete.

(5) (*b*) In the event of the refusal to act, or incapacity to act, of the Trustee representative or in case his term shall end due to election as an officer of THE SOCIETY, a successor to fill the unexpired term may be appointed by the Chairman of the Division to serve until the next succeeding annual election, at which time the unexpired term shall be filled as provided in Article WR VII, Sections (3) and (4) hereof.

Article WR XII. Committees

(1) (*h*) Change "Data" to read "Classification and Nomenclature."

Change to read:

(9) The Committee on Classification and Nomenclature shall consist of a Chairman and two other members of his selection. This Committee shall endeavor to develop a uniform classification and nomenclature for the whiteware branch of the ceramic industry. The members shall serve for one year. The Chairman shall be the Division representative on the Committee on Classification and Nomenclature of THE SOCIETY.

Article WR XV. Amendments

Change to read:

(1) Five (5) members, or the Chairman, Vice-Chairman, and Secretary, acting as a group, may propose an amendment and call for a vote thereon.

MATERIALS AND EQUIPMENT DIVISION

The following amendments to the Materials and Equipment Division Rules have been proposed by the Rules Committee and will be voted on by letter ballot. For Division Rules see *Bull. Amer. Ceram. Soc.*, **17** [10] 398–99 (1938).

Article MR VII. Nominations and Elections

Change to read:

(1) As soon as practical after he takes office, the Division Chairman shall appoint the Executive Nominating Committee of the Division. The Committee shall consist of three members of the Division. It shall propose candidates for the offices of Chairman, Vice-Chairman, Secretary, and Councillor and forward their names to the Division Chairman together with the written consent of the candidates at least one hundred and fifty (150) days before the opening date of the next Annual Meeting of THE SOCIETY.

(2) The names of the nominees of the Executive Nominating Committee shall be published in *The Bulletin* of THE SOCIETY at least one hundred and twenty (120) days before the opening date of the next Annual Meeting of THE SOCIETY. Any ten (10) members of the Division may, by signed petition, nominate an additional candidate for one or more of the offices, provided the petition, together with assurance of assent of the candidate or candidates, reaches the Division Chairman at least ninety (90) days before the opening date of the next said Annual Meeting.

(3) (*a*) The Division Chairman shall, at least seventy (70) days before the opening date of the next Annual Meeting of THE SOCIETY, forward to the General Secretary of THE SOCIETY the names of all nominees for offices in the Materials and Equipment Division. The nominees of the Division Executive Nominating Committee shall be indicated to the General Secretary, and he shall so designate them on the ballot. Ballots shall be prepared, submitted to the members of this Division, and returned as provided in the By-Laws and Rules of THE SOCIETY.

(*b*) The results of the election shall be determined and reported as provided in the By-Laws and Rules of THE SOCIETY.

(4) (*a*) The Division Executive Nominating Committee shall nominate one or more candidates for the office of Trustee representative of the Division and shall forward their names to the Division Chairman together with the written consent of the candidates, at least one hundred and fifty (150) days before the opening date of the Annual Meeting of THE SOCIETY at which the triennial term of Trustee representative expires. The names of the nominees shall be published in *The Bulletin* of THE SOCIETY at least one hundred and twenty (120) days before said opening date.

(*b*) The Chairman of the Division shall, at least seventy (70) days before the opening date of the next Annual Meeting of THE SOCIETY, forward to the General Secretary of THE SOCIETY the names of the nominees for Trustee representative made by the Executive Nominating Committee as well as any nominees by proper petition as provided in Section (2) hereof. The nominees of the Executive Nominating Committee shall be so designated.

(*c*) Delete.

(5) (*b*) In the event of election as President, Vice-President, or Treasurer of THE SOCIETY or in the event of refusal to act, incapacity to act, or the resignation of the Trustee representative of this Division, a successor shall be appointed by the Division Chairman to serve until the next Annual Meeting of THE SOCIETY, at which time a Trustee representative shall be elected to fill the unexpired term, if any, as provided in Sections (3) and (4) hereof.

Article MR XII. Committees

Change to read:

(1) The Standing Committees of the Division shall be as follows:

(*a*) Rules	(*e*) Papers and Program
(*b*) Editorial	(*f*) Research
(*c*) Membership	(*h*) Classification and Nomenclature
(*d*) Standards	(*i*) Industrial Management

Change to read:

(9) The Committee on Classification and Nomenclature shall consist of one member, appointed by the Division Chairman for a term of one year, who shall also be the Division representative on the Committee on Classification and Nomenclature of THE SOCIETY.

ADOPTED RULES OF THE STRUCTURAL CLAY PRODUCTS DIVISION OF THE AMERICAN CERAMIC SOCIETY*

Article SR I. Name

The official title of this Division shall be The Structural Clay Products Division of THE AMERICAN CERAMIC SOCIETY.

Article SR II. Purpose

(1) It shall be the purpose of this Division to stimulate the growth and activities of THE SOCIETY in the arts and sciences pertaining to the branch or branches of the ceramic industry represented in the Division enrollment.

(2) This Division shall represent THE SOCIETY in matters pertaining to the structural clay products branch of the industry, when specifically authorized by the Board of Trustees.

Article SR III. Membership

(1) The Structural Clay Products Division shall consist of those Fellows, Members, Corporation Members, and Life Members of these grades in good standing whose major interest lies within the field covered by the Division and who have instructed the General Secretary of THE SOCIETY to so enroll them.

(2) The following members in good standing enrolled in this Division shall be entitled to vote: Fellow, Member, Voter of Corporation Member, and Life Member of these grades.

(3) The following grades of members in good standing enrolled in this Division shall be entitled to hold office: Fellow, Member, and Life Member of either grade.

Article SR IV. Government

(1) The affairs of this Division shall be directed by an Executive Committee comprised of the elected Chairman, Vice-Chairman, Secretary, and Trustee.

(2) The term of office of the Chairman, Vice-Chairman, and Secretary shall be one year, to wit: from the close of one Annual Meeting of THE SOCIETY until the close of the next succeeding Annual Meeting, or until their respective successors shall have been elected and duly qualified. The term of office of the Trustee representative of the Division shall be three years, to wit: from the close of one Annual Meeting of THE SOCIETY until the close of the third successive Annual Meeting of THE SOCIETY, or until his successor has been elected and duly qualified.

Article SR V. Meetings

(1) The annual meeting of this Division shall be held during the week of the Annual Meeting of THE SOCIETY. The annual business meeting shall be an item on the Division program and the time of the meeting shall be conspicuously posted on the Division bulletin board.

(2) Fifteen (15) voting members of this Division shall constitute a quorum at any business meeting.

(3) Special business meetings may be called by any three (3) of the Division Executive Committee or by petition of ten (10) voting members on thirty (30) days' notice.

* Adopted at the business meeting of the Structural Clay Products Division held April 4, 1944, in Pittsburgh, Pa.

Article SR VI. Officers

(1) The Division Chairman shall have general supervision of the affairs of the Division. He shall preside, or, in the event of the refusal or inability of the Vice-Chairman, he shall appoint a substitute to preside at all meetings of the Division or of the Division Executive Committee. He shall be a member of the Committee on Sections and Divisions of THE SOCIETY. He shall not be eligible for re-election within a period of five years.

(2) The Vice-Chairman shall assist the Chairman as requested and shall succeed to the powers and duties of the Chairman in the event of the refusal or incapacity of the Chairman to perform them.

(3) The Secretary shall keep minutes of all Division business meetings and, after approval by the Division Executive Committee, shall promptly file a report of a meeting with the Editor of *The Bulletin* of THE SOCIETY for publication. He shall keep a full record of the correspondence of the Division.

(4) Any vacancies in the Division Executive offices occurring during the year shall be filled by appointment by the remaining members of the Division Executive Committee. A member so appointed shall not forfeit the privilege of election to any Division office.

Article SR VII. Nominations and Elections

(1) (*a*) The Division Nominating Committee shall consist of three members to be nominated and elected by secret ballot at the business meeting of the Division at the time of the Annual Meeting of THE SOCIETY. They shall choose their own Chairman. They shall serve one year and are not eligible for re-election prior to the third succeeding year. Their duties are to present nominees for the offices of the Division.

(*b*) It shall be the duty of the Nominating Committee to make two nominations for each of the following, to wit: (1) Chairman, (2) Vice-Chairman, and (3) Secretary. The names of the nominees together with their acceptance in writing shall be certified to the Chairman of the Division by the Nominating Committee at least ninety (90) days prior to the starting date of the Annual Meeting of THE SOCIETY.

(2) Additional nominations may be made by petition in writing of fifteen (15) voting members, providing the petition accompanied by the nominees' acceptance in writing is received by the Division Chairman ninety (90) days prior to the starting date of the Annual Meeting of THE SOCIETY.

(3) (*a*) The Division Chairman shall promptly transmit the nominations to the General Secretary of THE SOCIETY for publication seventy (70) days before the opening date of the Annual Meeting of THE SOCIETY.

(*b*) The ballots shall be prepared in combination with the ballots of THE SOCIETY by the General Secretary and the election conducted as provided in the By-Laws, Article B VII, Section (3), and the Rules, Article R VII, Section (3), of THE SOCIETY. A plurality of the votes cast shall constitute election.

(4) The Division Nominating Committee, functioning during the year prior to the Annual Meeting of THE SOCIETY at which the triennial term of the Division Trustee

representative expires, shall include on its slate of nominations the names of nominees for the office of Division Trustee representative.

(5) (*b*) In the event of election as President, Vice-President, or Treasurer of THE SOCIETY, or in the event of refusal to act, incapacity to act, or resignation of the Trustee representative of the Division, a successor to fill the vacancy shall be selected promptly by agreement of the majority of the other members of the Division Executive Committee. The appointee's name and acceptance in writing shall be promptly transmitted to the General Secretary of THE SOCIETY by the Division Chairman, and he shall serve until the next annual meeting. The unexpired term, if any, shall be filled by election of a Trustee representative prior to the next annual meeting as provided in Article SR VII, Sections (3) and (4) hereof.

Article SR X. Relations with The Society

(1) As soon as possible after each Annual Meeting of THE SOCIETY, the Division Chairman shall fill all vacancies of the Standing Committees of THE SOCIETY as currently required by the By-Laws and Rules of THE SOCIETY.

(2) The Division Chairman shall promptly appoint Division representatives to special committees of THE SOCIETY upon proper notification by THE SOCIETY.

(3) The Division shall not expend funds of THE SOCIETY or incur indebtedness without the formal approval of the Board of Trustees of THE SOCIETY.

(4) The provisions of the Constitution, By-Laws, and Rules of THE SOCIETY shall govern the procedure of this Division, but no action or obligation of the Division shall be considered an action or obligation of THE SOCIETY. This By-Law shall be imprinted on any publication issued by the Division.

(5) Authorization for incurring indebtedness by the Division for a purpose which has been approved by the Board of Trustees of THE SOCIETY shall be obtained by a majority of the members voting on a ballot which shall state the purpose and amount of the proposed expenditure and the agreement of the voter to a stipulated maximum assessment to liquidate the indebtedness. Such assessment shall be collected by THE SOCIETY and credited to the account of the authorized indebtedness.

(6) Special funds to be expended for an approved purpose may be collected by the Division or an authorized committee thereof. Such funds shall be deposited with THE SOCIETY, held in a special account, and paid out by THE SOCIETY for the authorized purpose in a manner currently agreed upon by authorized representatives of the Division and THE SOCIETY.

Article SR XII. Committees

(1) The Standing Committees of the Division shall be as follows:

(*a*) Rules	(*f*) Research
(*b*) Editorial	(*h*) Classification and Nomenclature
(*c*) Membership	
(*d*) Standards	(*i*) Education
(*e*) Papers and Program	(*j*) Industrial Management

(2) The Committee on Rules shall consist of a Chairman appointed by the incoming Division Chairman. He shall serve for one year and be eligible for immediate reappointment. He shall assist the Committee on Rules of THE SOCIETY as instructed on matters which may currently require Division representation.

(3) The Editorial Committee shall consist of a Chairman and two members, one new member being appointed each year by the incoming Division Chairman for a period of three years. The senior member shall be Chairman of the Committee in his final year. A retiring member shall be eligible for immediate reappointment as an incoming member. It shall be the duty of this Committee to act in cooperation with the Editor of the publications of THE SOCIETY and the Committee on Publications of THE SOCIETY as the By-Laws and Rules of THE SOCIETY may currently specify.

(4) The Committee on Membership shall consist of a Chairman appointed by the incoming Division Chairman and two members chosen by the Committee Chairman. They shall serve for one year and are eligible for immediate reappointment. It shall be the duty of this Committee to increase the membership of the Division.

(5) The Committee on Standards shall consist of a Chairman appointed by the incoming Division Chairman. He shall serve for one year and be eligible for immediate reappointment. He shall assist in the development of such standard specifications for materials, products, and tests as may be currently authorized by THE SOCIETY or the Division.

(6) The Committee on Papers and Program shall consist of a Chairman appointed by the incoming Division Chairman and two members chosen by the Committee Chairman. They shall serve one year and are eligible for immediate reappointment. It shall be the duty of this Committee to solicit technical papers and arrange the program of technical meetings of the Division.

(7) The Committee on Research shall consist of a Chairman appointed by the incoming Division Chairman. He shall serve for one year and be eligible for immediate reappointment. He shall represent the Division in matters pertaining to research activities of the Division and assist in such research activities of THE SOCIETY as permit of Division cooperation.

(9) The Committee on Classification and Nomenclature shall consist of a Chairman appointed by the incoming Division Chairman. He shall serve for one year and be eligible for immediate reappointment. He shall assist the Committee on Classification and Nomenclature of THE SOCIETY as instructed in matters which may currently require Division representation.

(10) The Committee on Education shall consist of a Chairman appointed by the incoming Division Chairman. He shall serve for one year and be eligible for immediate reappointment. He shall assist the Committee on Ceramic Education of THE SOCIETY as instructed in matters which may currently require Division representation.

(11) The Committee on Industrial Management shall consist of a Chairman appointed by the incoming Division Chairman. He shall serve for one year and be eligible for immediate reappointment. He shall assist the Committee on Industrial Management of THE SOCIETY as instructed in matters which may currently require Division representation.

(12) Any temporary Division Committee authorized by the Division shall be appointed by the Division Chairman for one year. A temporary Committee may be reauthorized by the Division and its members shall be eligible to immediate reappointment.

(13) The Chairmen of the Committees on Membership, Standards, Research, Rules, and Classification and Nomenclature may request assistants who on approval of the Division Executive Committees shall be chosen by the Committee Chairman.

(14) A Chairman of a Standing Committee of the Division shall represent the Division on the corresponding committees of THE SOCIETY.

Article SR XV. Amendments

(1) Amendment to these Division Rules may be proposed by petition signed by fifteen (15) voting members of the Division and presented to the Division Chairman.

(2) The Division Chairman shall promptly ascertain by written communication from the proper authority of THE SOCIETY whether the proposed amendment is consistent with the Constitution, By-Laws, and Rules of THE SOCIETY and, if so, it shall be voted upon by ballot.

(3) A two-thirds majority of the votes cast shall be necessary to carry an amendment.

CERAMIC CAMERA CLUB

If you were among those attending the Pittsburgh Meeting of The American Ceramic Society in April you could not fail to notice the interest in the Ceramic Camera Club Salon. There was hardly a time of day or evening when you could not find a group or two discussing the relative merits of the different exhibits. Interest and discussion of this kind are a compliment to the exhibitors and a stimulant to the contestants for better work next year.

But there are other thoughts suggested by this interest and by photography itself which are of vital importance to The American Ceramic Society. One phase of this was interestingly described by the speaker at the Camera Club dinner. In his talk, the speaker pointed out that each local camera club could work out an interesting program by cooperating with the local historical society. In every community, there are buildings of various kinds, points of interest, the old swimming hole, and many other things, including action shots of the fire department and the police department. All of these are commonplace to us today. We think nothing of them. But in ten, twenty-five, or fifty years they will have gone and will have real historic value. The local camera clubs can illustrate the local history and provide records not only of local but of national value in years to come.

A classic example of this was described in the discovery a few years ago of one of the tombs of an Egyptian Pharaoh. With the tomb was found drawer upon drawer filled with colored models showing the details of various phases of the life of that day. For instance, one set of models showed the preparation of meat, the butcher's trade of four thousand years ago. Such things as this are real "finds" for the archeologists. We of today could use more of this spirit of thoughtfulness for the future.

To apply this idea to The American Ceramic Society, there are methods and processes today which will be gone in five, ten, or twenty-five years. There are machines and equipment which will be gone. All of these can be illustrated and made a part of our permanent record. People say history repeats itself; well, that is because people forget the mistakes of the past. There is no adequate and easily understandable record, so we make the same mistakes over and over, in science, in art, and in human endeavor, all because we forget or fail to understand the records of the past.

"A picture is worth a thousand words." This emphasizes the value of pictures for The American Ceramic Society. A camera and a little imagination can tell a story, describe a process, illustrate a detail, and record human thought and progress. This is of immense value to The American Ceramic Society and to each of the various Divisions. My thought is not that we should disclose by photography the trade secrets of any industry but rather to tell the story of standard practice today, the history of tomorrow.

In this work the Camera Club can be an ally of each Section, Committee, or Division of The Society. The photographs so made would be of unusual interest in the Salon Exhibits each year and would give point to the exhibit, particularly to the Frazier Award. These photographs could be made in the plant, in the laboratory, in the museum, or maybe in the scrap pile. There is no end to what a little imagination can do even with the scrap pile, or the old model or pattern room.

Do not misunderstand me. Elimination of the three general classifications of pictures as used by the Ceramic Camera Club, i.e., Portrait, Pictorial, and Industrial and Scientific, is not advocated. The preceding suggestions would enlarge the Industrial and Scientific classification, but under the Pictorial classification we might find the picture of a wild flower, a tree, a bit of scenic beauty, any one of which might supply the motif for a decorative scheme or a new design in pottery, glass, or whatever it may be. A portrait, too, can have historic as well as artistic value. The pictorial always furnishes a welcome relief from the constant strife of this war-torn world of today.

To summarize these ideas and make definite suggestions:

(1) Enlist the active interest of the directors of The American Ceramic Society toward an increase in the membership of the Camera Club. The general purpose of this would be to have a "camera fan" on each committee to suggest or take an active part in the preparation of photographs to illustrate papers or to be used as a part of the historic work of The Society.

(2) Appoint a group or committee to serve each year to select from the annual Ceramic Camera Club Salon, or from other club sources, pictures which will be of value from a historic, scientific, or art standpoint to be kept as a part of a permanent exhibit. Each picture so selected should have a proper description of the purpose of the picture or the idea illustrated. History and development of the industry should be the basic principle of selection. This permanent display should be available to the members the same as *The Journal* or *Bulletin*.

(3) Make the Ceramic Camera Club an official Section of The Society.

These suggestions are made with the idea of creating some action, not just a general discussion.

—Donald P. Falconer, Member,
Ceramic Camera Club Board of Control

ENAMEL DIVISION BUSINESS MEETING AND PANEL DISCUSSION*

BUSINESS MEETING

The business meeting of the Enamel Division began at 12:30 P.M., Tuesday, April 4, 1944, D. G. Bennett, presiding.

The minutes of the 1943 meeting were read.

CHAIRMAN BENNETT: You have heard the reading of the minutes. Are there any additions or corrections? If not, they stand approved as read.

Now we come to the committee reports.

The report of the Committee on Classification and Nomenclature, G. H. McIntyre, Chairman, was read by Secretary D. G. Moore and approved.

The report of the Committee on Bibliography, which described the progress of the Enamel Bibliography in detail, was read by J. E. Rosenberg and approved.

Chairman Wayne Deringer then reported for the Committee on Rules.

MR. DERINGER: Mr. McAfee, the chairman of the Rules Committee for The Society, has instituted several changes in the By-Laws and Rules of The Society as a whole. For our Division Rules to conform with the Rules of The Society and By-Laws in general, we must make four changes.

Three major changes were made in the By-Laws and Rules, as follows: (1) The nominating procedure was changed to one nominating committee instead of two, (2) the ballot was changed so the Division nominations would be incorporated on the ballot for The Society as a whole, and (3) the Data Committee was dropped and the Classification and Nomenclature Committee was started. We should make these changes.

Article ER VII, Section (4) (*B*), "The Chairman of the Division shall transmit nominations to the General Secre-

* Held in Pittsburgh, Pa. Transcript received June 14, 1944.

tary of THE SOCIETY, who shall submit ballots by mail to voting members of the Division at least sixty (60) days prior to the Annual Meeting of THE SOCIETY," should be changed to read: "The Chairman of the Division shall transmit nominations to the General Secretary of THE SOCIETY, who shall incorporate said nominations on a general ballot according to the procedure prescribed in Article R VII, Section (3) (*a*), of THE SOCIETY Rules." *

The next change should be made in the same Article, Section (4) (*C*): "The Chairman shall have the ballots counted as soon as possible after the close of the voting and shall transmit the results of the election to the General Secretary of THE SOCIETY."

This paragraph should be deleted, inasmuch as the voting in the Division is to be incorporated in a general ballot for The Society as a whole.

The next change is in Article ER XII, Section (1) (*A*). The word "Data," under "Committees," should be changed to "Classification and Nomenclature."

The last change is in Article ER XII, Section (1) (*B*) (9). The original wording, "The Committee on Data shall consist of a Chairman and any additional members he may deem necessary, said members to be appointed by the Chairman subject to the approval of the Division Chairman. It shall be the duties of the Committee to collect and correlate desirable data at the request of the Division or of the Executive Committee. The Chairman shall serve as Division representative on the Data Committee of THE SOCIETY," should be changed to read: "The Committee on Classification and Nomenclature shall consist of a Chairman and any additional members he may deem necessary, said members to be appointed by the Chairman subject to the approval of the Division Chairman. It shall be the duty of the Committee to develop a uniform classification and nomenclature for the enameling industry. The Chairman shall serve as Division representative on the Classification and Nomenclature Committee of THE SOCIETY."

One other change, although not published in the Rules as yet, was acted upon two years ago, viz., the elimination of Committees A and B and changing our method of nominating to one committee. This motion changed the nominating to read as follows:

"The Division Executive Nominating Committee shall consist of three members, two of whom shall be elected by the Division and the third member of which shall be appointed by the Chairman of the Division with the approval of the Executive Committee. The third member shall act as Chairman of said Nominating Committee of the Section."

CHAIRMAN BENNETT: Any questions? You have all heard the suggested changes. I would like to entertain a motion that they be approved as recommended.

All of the changes were thereby in due form approved.

CHAIRMAN BENNETT: I hereby delegate to the Chairman of the Rules Committee the duty of seeing that these changes are properly incorporated in the Rules.

The report of the Rules Committee was then approved as read.

The Report of the Standards Committee, R. L. Cook, Chairman, followed. The report as read (see Bull. Amer. Ceram. Soc., **23** [5] 167–68 (1944)) *was in due form approved.*

CHAIRMAN BENNETT: The Standards Committee has recommended that five specific tests be adopted, two as standard tests and three as tentative standard tests. We will take them up in order, discuss them if necessary, and vote on them one after another.

The two standard tests, (1) the Reflectance Test for Opaque White Porcelain Enamels, developed by the Porcelain Enamel Institute and adopted by them as standard, and (2) the Test for Acid Resistance of Porcelain Enamels (Flatware), also developed by the Porcelain Enamel Institute, were adopted as standard tests of the Enamel Division with little discussion.

CHAIRMAN BENNETT: The first tentative standard is the Test for Resistance of Porcelain Enamels to Gouging. Is there any comment or discussion before we proceed?

MR. COOK: This test is a standard test of the Porcelain Enamel Institute and was published initially as a standard test. The usual procedure of publishing a test first as a tentative standard was not followed by P.E.I. In general, the Standards Committee feels that the proper procedure would be to adopt tests as tentative standards for one year, then act on them the following year, if it is advisable and there is no undue criticism or objection to their adoption as a standard test.

We recommended the first two tests for consideration as standard tests because they were approved in 1939 and again in 1941. We feel that it has been primarily an oversight that they are not already standard tests of the Enamel Division.

B. T. SWEELY: Before this test is adopted, it might be well for Mr. Moore to describe the gouging test. It is different from the other tests we have already accepted.

D. G. MOORE: I have not used the test very much myself, but I have seen it used a lot. Mr. Schwartz at the National Bureau of Standards first worked it out four or five years ago. The test differs from the test for surface abrasion, which measures only the loss in gloss of the surface.

The gouging test is supposed to indicate the understructure of the enamel, i.e., give a picture of the bubble structure. It is designed so that a small ball bearing $^1/_8$ inch in diameter is rolled across the specimen, which is usually 4 by 4 or 4 by 6 inches. The framework which holds the specimen is moved at a constant speed by a motor. Different weights are placed on the ends of a beam attached to the apparatus. The ball moves across the specimen as the framework moves. The end point is indicated by the number of lines caused by the gouging of the ball. Depending on the hardness of the specimen, more or less weight is put onto the end of the beam. The mark on the specimen caused by the rolling ball is examined by a Brinell microscope. By plotting curves, the point is obtained at which 50 per cent of the total path caused by the ball moving is gouged out.

G. H. SPENCER-STRONG: This test is very valuable. It shows quite a number of things about the resistance of surfaces to gouging. The test was made standard without the previous tentative period because of the war.

H. A. ROTH: Is the abrasion test to be used on many kinds of enamelware as the equivalent to the use of the scoring bar on table tops?

R. L. COOK: The gouge test is applicable to any field of porcelain enamel. A section of any enameled object can be cut and used as the test specimen. We have used the test at the University of Illinois and like it very much, as it gives a good deal of information regarding surface characteristics. In the selection of standard tests, one of the criteria by which a test should be judged is the ability of that test to be used by the greatest number of organizations concerned with porcelain enamel.

This test was in due form adopted as a tentative standard of the Enamel Division.

CHAIRMAN BENNETT: The second test proposed for adoption as a tentative standard is the Impact Test for Enameled Utensils that has been developed by the Enameled Utensil Manufacturers' Council. It has been recommended as a tentative standard.

F. A. PETERSEN: This test was published in *The Bulletin* last year.* It is one of three tests that have been accepted as standard by the Enameled Utensil Manufacturers' Council, and the member plants are using the standard test. It is also in CS 100-42, the commercial standard which covers enameled utensils.

MR. ROTH: Has this test been changed so that the force striking the surface is translated into foot-pounds or is it just in number of inches?

MR. PETERSEN: Rather than foot-pounds, we use the number of inches of drop, because we are interested in determining the spread obtained in testing pieces of different pans and setting up a minimum value above which the pans must rate in order to pass. In developing foot-pounds of energy, we do not accomplish our purpose any

* See *Bull. Amer. Ceram. Soc.* **19** [8] 306–308 (1940) for Division Rules.

* See *Bull. Amer. Ceram. Soc.*, **22** [8] 283–86 (1943).

further or better and it complicates the test procedure. We have found that by making the test procedure and calculations as simple as possible, the test is used and accepted more rapidly.

MR. ROTH: The point is that the utensil manufacturers can have their own little test, but if The American Ceramic Society wants to have the test, it must be in a form that cannot be criticized by the British or any continental society that might scrutinize it and translate it, for instance, in terms of the International Critical Tables.

R. L. FELLOWS: The Porcelain Enamel Institute also has an impact test. We should decide on one or the other for the Enamel Division test.

CHAIRMAN BENNETT: That test, Mr. Fellows, is restricted to tests for enameled utensils.

MR. FELLOWS: The same type of test could be used for either. In other words, the Porcelain Enamel Institute impact test was designed originally so it could be adapted to cooking utensils. We have used it on cooking utensils.

MR. PETERSEN: All of the hollow-ware manufacturers are actually using this test in everyday testing. The only P.E.I. impact machine equipped to test utensils of all sizes and shapes is at the National Bureau of Standards. The rest have the standard machine which is used for testing enameled tubes one inch in diameter.

MR. FELLOWS: As I understand it, the standard machine can be adopted with apparatus for holding any type of shape.

MR. PETERSEN: During the preliminary work on setting up some Government specifications, both tests were used and the E.U.M.C. test has been accepted, i.e., it has been accepted as the standard test on the procurement specification for kitchenware and hospital ware. It is also used as the standard test in CS 100-42, which covers enameled kitchen utensils.

We must keep in mind that the most important advantage of these standard tests is to have tests that are being used. If tests are not used, they are never changed. The tests should change once in a while, because that is the only way we will progress.

A. I. ANDREWS: The Enameled Utensil Manufacturers' Council and its members do not really care particularly whether The Society adopts the test or not. They have adopted these tests. If, however, we can have one test that seems to be satisfactory to the group that is most likely to use it, that is better than in the past when everyone was running a different test and giving results based on different tests, resulting in no basis for comparison. I would like to see one test adopted by all organizations so far as possible.

MR. PETERSEN: Bill Harrison has done considerable comparison work. He is more familiar with the test than any other man in the industry. On the basis of these procurement specifications, he has taken the attitude that since the utensil manufacturers have gone ahead with their program of standardization and all the various manufacturers have obtained the equipment for making the tests as they are specified, the test should be used, and the test specified in the procurement specification should be the same test as used in the plant.

MR. MOORE: The E.U.M.C. test has been adopted for the federal Specification Procurement Division. For a test of hollow ware, this test has certain advantages. It is the only test used now for that type of work. For a research test, the test that P.E.I. uses may have certain advantages.

MR. FELLOWS: The Enamel Division really wants a research standard test, not necessarily of products.

This is a technical society and we should have a test that could be used for scientific research work.

R. M. KING: To become valuable these tests must be used. If adopted as tentative now, within the next year much more work will be done, for adoption will encourage ts use.

MR. PETERSEN: Someone has stated that the one test was a research test. I would like to keep it clear that this test has been used in developing enamels, and over the last three years there has been a marked improvement in the properties of these enamels that can be referred back to the use of the standard test methods. This should indicate, therefore, that this test has some research value.

This test was adopted in due form as a tentative standard of the Enamel Division.

CHAIRMAN BENNETT: The last test is the Solubility Test for Enameled Utensils. This, I believe, is also a test of the E.U.M.C.

MR. COOK: It is a standard test used by the E.U.M.C. at the present time.

MR. PETERSEN: This test, a loss-in-weight test, was presented at the last meeting of The American Ceramic Society and will be published in the April issue of *The Journal.** The test specimen is cut from the bottom of an enameled utensil, weighed on an analytical balance after careful rinsing and drying, and placed in an apparatus that holds it tightly in place. A Pyrex-brand cylinder above the test specimen holds 150 cc. of a boiling 6% citric acid solution. A condenser tube is used to stopper the apparatus, and three of these units are placed on a hot plate. The solutions are brought to boiling, where they are kept for a set length of time. The apparatus then is dismantled, the test plates are carefully rinsed, dried, and reweighed, and the solubility is reported on a weight-loss basis in grams lost per square inch of wetted surface.

This test has been accepted as a standard of the Enameled Utensil Manufacturers' Council. It has worked out successfully and has given good classifications for various types of ware that have been tested.

This test was in due form adopted as a tentative standard of the Enamel Division.

R. R. DANIELSON: Some of these tests are already published and available to anyone interested in them; some of the latter tests have not been published at all. The Committee would do well to get these into print. It will be some time before The Society will have enough money to publish them all. These tests therefore will not be available. The first we hear about it is a few remarks on a test we have already adopted here as a tentative standard test. The other tests that have been published by the Institute are readily available in book form.

MR. PETERSEN: The Enameled Utensil Manufacturers' Council intends to publish all the standard test methods in booklet form. They will therefore be available to any member of the Enamel Division. Of course, they are now available in various commercial standards and specifications.

Chairman Bennett then presented H. D. Carter, Chairman-Elect of the Enamel Division.

MR. CARTER: Mr. Fritz states that we are one of the Divisions which has no autumn meeting. He suggested that, to interest shopmen, we might have an autumn meeting on shop practice.

PROFESSOR KING: That question arose two or three years ago. There was a gentleman's agreement that the Enamel Forum of the Porcelain Enamel Institute would be the autumn meeting of the Enamel Division of The American Ceramic Society. We abandoned the Forum for obvious reasons. There is some talk of having it again this autumn.

MR. CARTER: Could the Forum meeting be publicized more through The Society?

PROFESSOR KING: It is every year. The Society carries the publicity for the Forum.

PROFESSOR ANDREWS: We used to have numerous small meetings of the enamel group, e.g., symposia at the University of Illinois, at Ohio State University, and at the Ferro Enamel Corporation. When the Porcelain Enamel Institute inaugurated the Enamel Forum there was a gentleman's agreement to cancel the small meetings and have one large meeting. It was fortunate that we did so. The Porcelain Enamel Institute Forum has been very successful, and in the future we can depend upon the Porcelain Enamel Institute to have a Forum, if there is a good reason for having it at the particular time. It was

* See *Jour. Amer. Ceram. Soc.*, **27** [4] 113–15 (1944).

cancelled last year, obviously because of the war condition when so many men could not attend and so many plants were shut down; this year it is being considered. The Committee plans to have a Forum if it seems desirable. An autumn meeting would be unnecessary duplication under these circumstances.

The business session adjourned at 3:00 p.m.

PANEL DISCUSSION

The Panel Discussion session convened Wednesday afternoon at 3:00 P.M., D. G. Bennett presiding.

Members of the Panel were as follows: Frank R. Porter, Inland Steel Co., Indiana Harbor, Ind.; B. T. Sweely, Chicago Vitreous Enamel Product Co., Cicero, Ill.; R. M. King, Dept. of Ceramic Engineering, Ohio State University, Columbus, Ohio; R. R. Danielson, Metal & Thermit Corp., Carteret, N. J.; Charles S. Pearce, Porcelain Enamel Institute, Washington, D. C.; A. I. Andrews, Dept. of Ceramic Engineering, University of Illinois, Urbana, Ill.; and L. E. Nordholt, Tennessee Enamel & Mfg. Co., Nashville, Tenn.

CHAIRMAN BENNETT: We will go straight down the list of questions, with fairly short categorical answers. There will be no questions from the audience nor discussion at this time, because we could thus bog down easily. In one or two cases, a question asked a panel member will be passed on to an expert who will be especially prepared to answer that question. If that man is here only to answer that question and must leave, we will deviate from the rule and question him before he leaves.

After we have gone through the list of questions, we hope to have about one hour left. If a question occurs to any of you, it can be answered then. We will go over everything as carefully and as thoroughly as time will permit.

Ask your questions of me, because this is my pitching staff, and I do not want them to pitch out of rotation. The right man therefore will receive the question.

The original list of forty questions, which you all have seen, was a compilation of questions received in answer to a questionnaire sent to plantmen by Program Chairman Herb Carter. Those questions were printed verbatim as they were received. As many of them were duplicates, we have worked them down into a short form, but the origin of the short-form statements or questions is noted.

The first section, on steel, is compiled from questions 19, 20, 21, 22, 23, 28, 29, 30, and 33. The first question is as follows: *The progressive attitude of steel producers has been questioned. What progress has been made in developing steels to take one-coat whites?* Mr. Sweely!

MR. SWEELY: I shall undertake to say a word for the steel companies. I have heard the statement that there has not been as progressive an attitude toward research by our steel producers as might be desired. I want to take exception to it. Like a great many other research projects, it is not ready for development. It is not yet ready to turn over to you, to use in your plants, but from close contact with at least three or four of the producers of enameling stocks, I have found that they are doing an excellent job. They have made real progress and will have improvements in enameling stock to show us when we are ready to start production again.

CHAIRMAN BENNETT: *The excessive warpage of present-day enameling stock is assumed. How can this be remedied?* Mr. Porter!

MR. PORTER: I assume that the person who asked the question is referring to enameling iron. Mild steel or automobile sheets are bound to warp and sag more, so I will confine my remarks entirely to enameling-iron stock.

Several things will influence warpage, e.g., the temper of the metal, whether for drawing or for flatwork. A stiff sheet unintended for shallow draw will be warped before it goes into the fire and may be strained when it does.

The uniformity of the stock, of course, affects warpage to some extent. The enameling-iron producers can do little about it except make the iron the best they know how.

Methods of hanging and firing also affect warpage. The sag resistance of enameling iron is much better than steel. It is the best metal to use for enamel. At the present time, therefore, I cannot personally hold out any hope of improving the metal itself except to see that the proper sheet, properly tempered, is used for the job and that the rest of the processing in the enameling shop is carried out the best we know how.

CHAIRMAN BENNETT: *Why does adherence vary from sheet to sheet in the same lot of steel?*

PROFESSOR ANDREWS: In the first place, no one knows exactly why this variation occurs. It is, however, a logical thing to expect. Steel is prepared for enameling by cleaning it and by pickling. Corrosion varies from time to time and from place to place on a sheet, so we cannot expect to obtain absolutely uniform results. We probably can improve the preparation of the sheet for enameling.

Steel processing at the present time is not well enough controlled to actually produce the same surfaces on all sheets. As enameling depends upon the oxidation of the iron during the heating-up process before the enamel is melted, the oxidation characteristics of the iron undoubtedly have an important bearing on adherence. The answer to this question may be found by studying the rate of oxidation of these different steels.

PROFESSOR KING: I know very little about steel and its uniformity, but I would like to make this general comment. Someone asked this morning why steel is so nonuniform. Of course, uniformity is a matter of degree. Compared with cast iron, enameling iron is much more uniform, but difficulties will be encountered with almost any iron. In the last ten or fifteen years I have investigated at least ten different materials for use in the enameling industry and in some other industries. The first question I ask is, "Can you supply this material in a uniform quality and quantity?" "Yes," is always the answer, so I take their word for it. When, however, the investigation is concluded and the material is used, nonuniformities are found.

As more precision in enameling operations is obtained and more is expected of them, more nonuniformities probably will be encountered, although from the standpoint of manufacturing the steel will be more uniform. This may be considered to be a difficulty. As I understand it, in open-hearth operations, particularly in making enameling stock, when trying to bring parts of carbon, iron oxide is also present and a certain amount goes into solution. If a small amount of iron oxide is included or some open-hearth sluffing begins immediately, a center for galvanic action is created. When the electrolyte is placed between the two materials of different states of oxidation, corrosion starts immediately. Even absolutely pure iron may still have nonuniformities.

CHAIRMAN BENNETT: *With experience still accumulating, is hydrogen still considered to be the chief "Bogey Man" in steel?*

PROFESSOR ANDREWS: I do not know whether it is necessarily the hydrogen in the steel, but I am firmly convinced that hydrogen has a lot to do with our enameling procedure. Maybe Carl Zapffe would like to say something about it.

DR. ZAPFFE: I have spoken at length before and have filled your literature with much excessive verbiage because at that time I thought you did not understand the hydrogen part of steel. Since then, I have found your attitude to be fair and encouraging and the matter is now in better hands than mine. I will say nothing about it now unless something comes up later in which I might have a word.

MR. SWEELY: I would like to add a point about hydrogen. Charlie, how many people in the United States are in the enameling industry?

MR. PEARCE: Twenty-five or thirty thousand.

MR. SWEELY: Each one has a theory about hydrogen, so I will not add mine. As a matter of fact, I do not know enough about it to formulate a theory, but there are many different opinions. The steelmakers have some, so I am going to pass this to you, Frank. I have some information that might be helpful in the actual manufacture of steel, the source of hydrogen; in other words, preceding its use in the enamel shop. Can you add anything to that?

MR. PORTER: I cannot at the present time. I agree with Professor Andrews and Mr. Sweely that hydrogen plays a big part in many of the defects that arise in enameling, as one can see when putting white enamel directly on steel or enameling iron (if anyone wants to try it on the old enameling iron). But hydrogen is not the only source of the trouble. If hydrogen could be eliminated, a great many, if not all, enameling troubles might be eliminated, but many other things must be eliminated, too. There are many sources of hydrogen in steelmaking, from the actual steelmaking and the various heating periods that steel goes through to the hydrogen pickling after the final heat-treatment before it is shipped.

I feel, however, that hydrogen in the steel has less to do with enameling troubles than the hydrogen that comes from the enamel itself. That is my own opinion. I am one of the thirty thousand.

CHAIRMAN BENNETT: Section II, Pickling, from questions 1, 2, 3, and 4: *Discuss pickling, especially new methods which embody radical changes in pickle practice.*

MR. SWEELY: The question of the so-called dry pickling was on the original list. Mr. Weller of the Surface Combustion Company is here to discuss this question for you, as his Company has done the most work on this problem. Mr. Weller!

H. C. WELLER: I am pinch-hitting for Dr. Tourney, who joined the Navy fourteen days ago. He has written a book on dry pickling. I have a few notes from his book to read to you, so do not ask me any surplus questions I cannot answer. I want you to have the picture of what we are doing, what we are trying to do, what has been done, and what should be done so far as the enameling process is concerned.

HISTORY OF GAS PICKLING

The development of gas pickling began about seven years ago. Experimental work was first undertaken to work out a method of preparing strip for galvanizing which would eliminate the sources of trouble encountered with conventionalized pickling, viz., residual impurities left after pickling, including organic contamination not removed in pickling, and the hydrogen left in the steel by the pickling process which was a potent source of blisters in galvanizing.

Development work was carried through a series of laboratory experiments, followed by the construction of several continuous pilot lines. In 1940, the first commercial unit was placed in operation at the Sharon Steel Corp., Sharon, Pa., to anneal continuously and pickle cold-reduced steel strip up to 24 inches wide. This strip was galvanized continuously as it left the pickler and was recoiled at the end of the line.

Installation of additional production lines for the application of gas pickling was held up by the pressure of war activities. The original line at Sharon has remained in operation, however, and is still turning out a premium galvanized product for special wartime requirements.

Fundamentals of the Process: The gas-pickling process consists essentially in treating an oxidized steel surface at high heat with a bath containing hydrogen chloride and little or no water vapor. The reaction of hydrogen chloride with the iron oxides and the steel base metal results in the formation of vaporized chlorides of iron. As the process is carried out at red heat, all organic impurities, such as rolling oils, are completely burned off before the oxide is removed. The resulting surface, therefore, is chemically clean and has a characteristic pattern of etch totally different from the pattern on an acid-pickled surface. The etching pattern is characterized by a sharp penetration of the surface at all grain boundaries of the steel, indicating a selective action which tends to remove any impurities segregated at these grain boundaries.

This pickling action, in the temperature range from 1100° to 1350°F., is very rapid. On the Sharon line, the entire operation of preheating, pickling, and hot galvanizing is accomplished in about one minute, thereby permitting high line speeds and correspondingly high production rates.

Results of Gas Pickling: The galvanized strips prepared by gas pickling show unusual adherence of the coating to the base metal and a total lack of the blisters secured in other processes. The vast improvement in adherence is attributed to the cleanliness of the surface and the intimate bonding secured with the type of etch resulting from the gas-pickling action. This coated strip will withstand severe drawing and forming operations without flaking of the coating and can even be rolled to thinner gauge after coating without any loosening of the bond.

Because cold-reduced strip is cleaned of organic material, annealed, and pickled in one operation, the cost of the finished product compares favorably with strip made by more conventional methods.

Possible Future Applications: Preliminary tests indicate that coatings other than galvanizing also have superior adherence on gas-pickled surfaces. For example, a thin lacquer film can be stripped readily from an acid-pickled surface which has been lightly oiled before application of the lacquer. With the same treatment, the film tightly adheres to a gas-pickled surface, evidently due to mechanical interlock in the etched grain boundaries.

The process obviously has interesting possibilities for the application of ferrous enamel coatings. Many of the troubles now encountered in enameling undoubtedly can be attributed to the organic impurities on the steel surface or to hydrogen and metal salts left by the pickling process. To our knowledge, gas pickling provides a means of eliminating these factors entirely.

This article will appear in *Iron Age* under April 20 and will describe dry pickling in more detail.

We are furnace builders and are interested only in building furnaces. If a process is connected with it, whoever has a furnace can have the process. The gas-pickling process is patented and has many possibilities which have yet to be worked out, but it is in the realm of our contribution to make dry pickling a goal to be attained.

CHAIRMAN BENNETT: *Mr. Sweely, what about modulated control of furnaces? How well does the radiation pyrometer control the short-time heating of steel and can photocells do the job?*

MR. SWEELY: Again, I sought help. I asked the Brown Instrument Company, one of the builders of this type of equipment, if they expected to have a representative at Pittsburgh during this Meeting. They advised me that their Mr. Green would be here to tell us about modulated control and the radiation pyrometer. Mr. Green!

MR. GREEN: A question of terminology originated that question, as far as modulated control is concerned, because it is really quite elementary. Unfortunately, the industry as well as ceramics applies a number of terms to the same thing. Modulated control is exactly the same as proportional control, proportioning position control, or throttling, i.e., multiposition fuel input.

You know it simply as the P2 position or high-low fire operation where, when the temperature is above and below a point, the fuel balance assumes definitely high and low positions, whereas the so-called throttling, modulating, or proportioning control simply substitutes a definite control point, *WA*, over a definite band with changes in the temperature at a low end of the scale. We will have a high fuel input; as the temperature increases, it will decrease through the entire range, i.e., more than two positions.

To reduce it to enameling practice, there are certain advantages in two positions with the simplicity in many types of batch-type enameling furnaces. For example, as soon as the temperature drops from the control point, full fuel flow on the furnace is obtained, which tends to bring the temperature back to the desired point. It does have the advantage, however, of being fundamentally like nature. You cannot get away from it.

In a batch-type furnace, we must drop farther in temperature to exceed this control band to obtain full fuel flow, and the fuel is gradually reduced as it is brought up to the full point. We will return to the desired temperature with each batch load faster with two positions than with modulating proportioning control.

Also, furnaces that require for heat distribution a uniform flame length must have the two-position form of firing to obtain even distribution throughout the furnace.

The modulating form of control comes into its greatest use in continuous furnaces where there is no radical change, such as in a batch-type furnace as far as load. It therefore will hold a closer temperature, the objective in this type of work.

I am not familiar with all of the recent installations of radiation equipment for measuring the surface or finish temperature of the sheet in enamel operation. Those places with which I am familiar, however, have reported continuously satisfactory results with that method of firing, which consists of sighting onto the piece itself a radiation form of instrument which takes the radiant energy emitted from the piece and reads it as degrees. Degrees, however, mean nothing in that particular case. Actually the composition of the enamel used will vary its emitting properties and therefore change the reading on the instruments so that there must be a definite reading for a definite enamel composition. It really makes no difference whether degrees or amperes are read. It is fundamentally a time and temperature problem.

The whole advantage of radiation pyrometer control is the ability to detect on the enamel surface itself the temperature condition which will mature the enamel rather than depending upon the furnace temperature, which from experience in tests of this type of firing is radically different from the readings of the sheet itself, that also independent of the gauge of the material which is being enameled, as a true surface temperature is being measured, influenced, we must all recognize, by the reflection from the furnace to the instrument itself as well as the radiant energy emitted from the surface itself.

CHAIRMAN BENNETT: How about the photocell?

MR. GREEN: Photocells operate in their fundamental principles similar to the radiation form of measurement. It is true that they use a different wave-length spectrum than the total radiation instrument. There is no reason why a photocell should not do a similarly good job.

MR. PEARCE: Mr. Green, what are the effects on fuel cost?

MR. GREEN: That is a problem which will be placed right back to surface combustion, in the furnace builder's lap. It is fundamentally entirely dependent on the design of the burner and of the furnace. Fundamentally, we should be able to ratio fuels as far as the efficiency of firing by either method with about the same results. Nothing particular is to be gained in that respect.

H. E. SCHABACKER: Does the angle of sighting make a difference?

MR. GREEN: Fundamentally, it does not. The principles of radiation apply on the photocell form. We increase the area, and it is actually the emittance from the piece which is measured in the radiant energy.

E. E. BRYANT: Do you ordinarily make any provisions for the wave length of radiation that you measure?

MR. GREEN: No, that presents the tricky problem, of course, of what the enamel may transmit in certain wave lengths. Actually two standard forms of wave lengths are used. One takes the wave lengths up to 2.6 microns and the other up to 3.8 microns, but for measuring the surface conditions (temperature, if you like) of enamel, either one may be used, unless there are certain wave lengths to which the enamel surface itself emits at a higher level.

MR. BRYANT: I was thinking of the radiation of gases from firing. Do you have any provision for eliminating the infrared?

MR. GREEN: We are getting quite high in the infrared with any radiation form of measurement. To clear that up, I shall draw on the blackboard a typical curve of energy transmission of radiation in B.t.u. per square foot for a temperature; these are plotted against wave lengths.

This is a rough curve, but the visible spectrum is down here, this being one micron, and practically all radiation measurements come out in some point here or there, for the measurements.

An unfused material will emit a lower amount of radiation than a fused material, which gives at the fusion point a steeper curve on the response from the instrument.

MR. SWEELY: Would we have to modify the firing of ground coats as compared with the firing of cover coats with such type of coat or is that based on the assumption that when the high temperature is reached both are reasonably active, good black bodies?

MR. GREEN: You would probably have to set the reading which from experience showed a mature enamel on either a ground or cover coat. They would be at different readings on the instrument. We make no effort and no effort should be made to say that is a true temperature. We could spend all afternoon covering the difference between reflectance from the furnace walls. The emittance I am talking about is the emittance from the material itself. Making up unity in that is the amount which is reflected from the furnace walls. It all adds up to one. The basic fundamentals are that when the emittance goes down automatically, the reflectance goes up, so that if a cover coat has a low emittance, it immediately means that it is reflecting more of the radiation which is coming from the furnace to the instrument.

PROFESSOR ANDREWS: That would only be true, though, if you had uniform temperature in the furnace and on the piece.

MR. GREEN: You mean that we would be reading a true temperature? That is quite true. That is why I wanted to bring out the point that we are not attempting to read true piece temperature. It purely must be arbitrarily set on the maturing of the enamel slip and holding a fairly constant furnace temperature. We vary the reading secured at that point by either raising or lowering the furnace temperature or the temperature of the piece. With one of them established as constant, the other gives a reading which is not a reading in degrees of the mature condition of the piece.

CHAIRMAN BENNETT: The two preceding questions were taken from Section IV (*b*), Enamel Firing. We will go back to Section III, Enamels and Their Properties. Questions 13, 14, 15, 16, 17, 18, 31, 32, 37, and 39 have been combined to make this statement.

The questions are: *Have antimony-free enamels shown enough to keep them in the postwar picture? What causes scumming in such enamels? How can it be overcome?*

MR. DANIELSON: If the answer to the first question is "No," we are betting on the wrong horse. Any enamel that is fairly useful, as this kind has been over the past years, will certainly return to be used in postwar practice. After all, though, we must realize that those enamels are not universal. They have certain shortcomings. No one has been able to develop acid-resistant enamels with zircon materials. For that type of enamel, we must return to the use of antimony or an antimony compound.

It is hard to say what causes scumming in such enamels. There may be a number of explanations. The zircon may tend to crystallize readily under certain conditions. Also, gas bubbles may form. Scumming is common not only to enamels but to glazes. The same difficulty is encountered in glaze practice as in enamel practice. How it can be overcome, I do not know. Certain compositions show more scumming than others. On the whole, the zircon enamels are not as free from scumming as some of the enamels used in previous practice.

CHAIRMAN BENNETT: You would say then, Mr. Danielson, that attention to composition is important?

MR. DANIELSON: Yes. Certain other factors enter into it, e.g., furnace gases. Any furnace that possibly contains water vapor or other reducing gases tends to aggravate that condition.

PROFESSOR ANDREWS: Scumming of either zircon or other enamels could be caused by the materials used in the mill batch. Frequently scumming finds its source in an improper mill batch.

MR. DANIELSON: What particular materials?

PROFESSOR ANDREWS: Clays and opacifiers. I have no direct evidence that the electrolytes do, but they may also affect it.

CHAIRMAN BENNETT: The next question is blunt and to the point. *Can ordinary ground coats withstand weathering?*

PROFESSOR KING: Some years ago a company in New York which makes water filters sent an outside jacket to

me. It was about one quarter of an inch thick, six inches across the top, and twelve inches deep and had a capacity of about one and one half gallons. Ground coats on the inside were in contact with tap water which was being filtered. The inquiry came as to how this might be remedied. I asked them to send one of them to me, and you should have seen it! Iron oxide was built up in localized areas to the depth of probably one half inch. Dug out, they left craters one half inch at the top and one quarter of an inch deep.

I suggested that they put on a type of acid-resistant cover coat, which seemed to work pretty well.

A water closet installed twenty years ago was made of 16-gauge steel enameled only with ground coat. The last time I saw it, it was in bad condition.

About 1935, there was some opposition to giving washing machine tubs just one ground coat. Later some were enameled. I have never heard how they came out. I would say that ordinary ground coat alone would not be weather resistant. Of course, those were extreme cases, but in time the ground coat would fail.

MR. SWEELY: I presume that the author of this question had in mind weathering in at least some cases of porcelain enamel signs exposed to the outdoor atmosphere. The location of the sign, the place at which it is erected, will have a great bearing on whether or not the enamel will stand weathering.

The Porcelain Enamel Institute made a number of panels and exposed them to weathering conditions in three or four different locations. The results indicated that in city areas the use of acid-resisting enamels was highly desirable. The nonacid-resisting enamels did not withstand weathering nearly so well as the acid-resisting enamels. As ground coats in most instances are not acid resisting, it seems reasonable to expect that they will fail in city areas. Signs erected without a cover coat on the back in city areas free from sulfurous fuel gases seem to hold up quite well. Few, however, who have examined signs under those conditions will feel that such an enamel is suitable for the face or character side of the sign. Failure is much earlier than it should be.

PROFESSOR ANDREWS: The person who asked the question probably wondered whether just a ground coat would be satisfactory. We should never have just a single coat as a corrosion-resistant enamel, because the ground coat must carry a bubble structure and cannot be expected to be as durable as a cover enamel. Two coats of ground coat, a coat of ground coat over the ordinary ground coat, would be quite durable.

CHAIRMAN BENNETT: *Can bubble-opacified enamels stand up to wear?*

MR. NORDHOLT: No, they do not stand up to wear nearly so well as other types of enamels because the bubbles break down on the surface and the enamel loses its gloss.

CHAIRMAN BENNETT: *What are the latest ideas on opacification?*

PROFESSOR ANDREWS: There have been no changes in the ideas on opacification so far as I know. The theory and practice have been well worked out and standardized. Many factors must be controlled to obtain good reflectance, e.g., the size of the particles that make up the opacifying material in the glass and the solubility of those materials in the glass, the bubble structure of the glass, and, from the operating standpoint, the fineness of the enamel and the clays used.

CHAIRMAN BENNETT: The next question incorporates several thoughts into one. As they all have something in common, we will discuss them as one question. *Discuss experimental smelting, crucible vs. rotary, and compare crucible vs. larger plant batches; also the importance of mixing and particle size of raw material.*

MR. DANIELSON: From my own experience, I feel that crucible smelting is unsatisfactory for the amount of gas in enamel. There is always a relatively great depth and a tendency under those conditions to trap gases that would disappear in the ordinary smelting procedure. We have used small rotary furnaces which have checked closely with large batches smelted on a commercial scale.

MR. SWEELY: Making an enamel is the process of bringing the ingredients of the enamel batch into as intimate contact as possible and heating them until they react. It is obvious that if our materials are fine and mixed thoroughly, we will obtain a better enamel than if the ingredients are coarse and we do a poor job in bringing them in contact with one another.

MR. DANIELSON: Certain materials warrant thorough mixing. Some materials tend to ball, e.g., antimony oxide. In making oxide with materials of that size, they must be mixed thoroughly. Another material is titanium oxide. If it is not mixed thoroughly, titanium oxide will be reduced to titanium. Generally, much can be accomplished by mixing the materials thoroughly before smelting.

PROFESSOR ANDREWS: I agree with Danielson's remarks about crucible versus large smelter operations, but he left the impression that we could not depend upon crucible smelting in the development of enamel compositions. There is a big difference between crucible smelting and the enamel obtained in the larger-type smelters, but they are correlated. If we will work along with the crucible, then in the semiplant batch, and then in the plant batch, we will save a lot of materials, time, labor, and expense. Crucible smelting, therefore, although it does not give the final answer, is a good way to get rid of a lot of questions about composition before we reach the big batches. We always follow through in the three streams, crucible, small-size, and commercial smelter.

MR. DANIELSON: That is perfectly right, but that is the question—whether the small crucible batches give exactly the same information as the large batches. You say they do not, and I agree with you.

PROFESSOR ANDREWS: I did not contradict you, but I was afraid the impression was given that we could not use crucible batches.

MR. DANIELSON: We do make crucible lots many times. It is desirable to do this, but we certainly must follow the procedure you have outlined. We must step up in the larger batches. That is undoubtedly a common experience with those who develop enamels continuously.

CHAIRMAN BENNETT: *What causes pits in black dry-process enamel?*

MR. DANIELSON: So little black dry-process enamel is made that it is not a great problem. When the black oxide is milled with the glass, the best conditions are not obtained. The oxide, composed in most cases of cobalt oxide or manganese oxide, probably gives off gas under certain conditions and causes a pitted or pinhole condition.

To make a good black enamel, do not mill in the oxide. The color material should be smelted in with the raw batch. Also, an irridescent effect occurs readily on black enamels. Place a moistened finger on the ware and the black finish is spoiled. When that condition exists, the finish is not manufactured correctly.

CHAIRMAN BENNETT: *What are the causes of hairlining?*

MR. SWEELY: What do we mean by hairlining? Hairlining that appears in the ware as it comes from the furnace is frequently caused by residual strain in the part or distortion that takes place during the firing of the ware. A residual strain after forming can result in distortion which exceeds the elastic strength of the ground coat. Fracture therefore occurs which ruptures the continuity of the dry coat of cover enamel. Owing to viscosity, the enamel tends to pull back from the fracture to produce the ground-coat or dark-colored hairline. The white hairline is probably closely related to the dark hairline, but it occurs over a fired coat of white enamel. The design and forming of the parts influence the hairlining tendency.

A particularly troublesome item of fifteen or twenty years ago was what was called the rolled front shelf on the old cabinet gas range. We had a high shelf or top shelf. One method of making it was to put the edge of the sheet in a slot on the rod, turn the crank, and wind it around the rod until it formed a roll. If we wanted to have some fun with hairlining, we tried to enamel some of them, particularly in the box furnaces used in those days. The continuous furnace also has helped considerably in overcoming some of these problems.

Now hairlining is also encountered and is really a craze, if we want to adopt the term from the whiteware industry, in that it is a failure after the enamel has been applied and fired and put into service. This type of defect is usually caused by a localized heating condition or a sufficient distortion of the piece to cause failure of the enamel in tension. It is not too unusual, unfortunately, particularly on the burner holes on certain types of gas-range tops.

I was recently particularly struck with an incident in regard to that type of defect. Home canning has resulted in quite a number of cases of this type of failure on ranges.

This particular canner sets down over the burner. The pressure in the canner runs from 10 to 15 pounds of steam, which is about 260° or 270°F. A ring setting down over the burner confines the heat from the heat source within the ring. The top on which it is resting is free to cool. It is not unusual, after one or two hours' use, to find a lot of little hairlines surrounding that top. They are usually at right angles to the periphery of the burner hole. On an electric range that came under my observation, hairlining took place in one afternoon.

We must therefore keep in mind the type of service to which the enameled article has been subjected. I do not know how this defect may be remedied. We must deal with it, however, and it will be hard to persuade the stove manufacturers to change their stove designs.

CHAIRMAN BENNETT: Next we have Section IV, Division (*a*), Enamel Application, from questions 5, 6, 8, and 12. *Discuss electrostatic spraying and vehicles other than water.*

MR. SWEELY: Mr. Hoehl, of the Wolverine Company, and I asked Mr. Ransburg, of the Ransburg Company, who has developed electrostatic spraying, to tell us about the process. He intended to be here, but, unfortunately, could not.

I know little about it, but Mr. Hoehl can give us some information.

J. W. HOEHL: I may not be in a position to give intelligent enough information on this process, but I did get to spend one day at the plant in Indianapolis and see the process in operation on paint. I was quite impressed, and it should have possibilities for porcelain enamel. I also saw samples of porcelain enamel sprayed. The necessary equipment for this process is a so-called power pack consisting of insulated electrodes which create or surround a so-called field. The electrodes are connected to a transformer which is built to create a high voltage and low amperage. It imparts to the piece which is to be sprayed an electrostatic charge which attracts the sprayed particles to the piece.

The whole process is regulated by a control panel. They use stationary spray guns and have low air pressures and a much lower pressure for the liquid than used in regular spraying. The pressure used on those samples was six and seven pounds on the liquid and twelve to fifteen pounds on the air. As the ware moves along on the conveyer and enters the electrostatic field, the enamel or porcelain enamel is sprayed at a certain angle to the piece. The electrostatic charge attracts the particles sprayed to the piece in such a way as to obtain a fairly even covering of the piece with little over-spray. That really is the main saving.

The exhaust takes practically nothing out. A stove company claims to save as much as 30% of the sprayed enamel.

The process looked interesting to me. After more experimenting and trials we should be able to use it, particularly on production runs. It cannot be easily adopted for a lot of mixed ware or short runs. It requires automatic spraying. It will depend a lot on the shape and the size of the pieces to have the correct field of electrodes. In some cases, half a dozen spray guns may have to work simultaneously to cover a piece correctly.

Besides the material savings there should be a saving in electric power, because there is less air pressure, less exhaust, less heat loss in the building because of less exhaust force, and there is less nuisance.

CHAIRMAN BENNETT: The last part of the question remains: "vehicles other than water." I hope the panel can tell us what to use other than water. All I have ever heard was that it would be nice if we could.

PROFESSOR ANDREWS: We have tried pretty hard to obtain a vehicle other than water for enamels. When Carl Zwermann was working with me we tried many different kinds of organic materials. Except for the conditions which are present when applying decoration, we failed to obtain the proper suspension when using materials other than water. It is not impossible, though.

CHAIRMAN BENNETT: *Mr. Nordholt, will you discuss enamel distribution in spraying; stack losses, reclaim, and, by assumption, how much goes on the ware?*

MR. NORDHOLT: I can only say that a water-washed spray booth saves practically all the enamel that fails to go on the piece. The loss is very low. Some of the material may have to be resmelted for reuse, but practically all of it can be used. The amount of enamel that gets through a good water-wash spray is negligible.

CHAIRMAN BENNETT: Can some of it be used as it is?

MR. NORDHOLT: A lot can be used as it is. All from the booth itself and from the air chamber back of the booth can be used. Some are using the material obtained from the wash system. We, however, dry all of that and resmelt it.

CHAIRMAN BENNETT: The next question: *Can both base and finish coats be fired together?*

MR. NORDHOLT: One of the biggest problems in developing a ground coat that would fire with the finish coat was the sag when the subsequent coats were put on, especially on large pieces such as signs. Some, however, have eliminated sag by making viscous ground coats, not ground coats that had to be fired at high temperatures, obtaining their viscosity through their firing temperature, but viscous ground coats that would mature at low temperatures.

Antimony-free enamels can stand a little more fire than the antimony enamels. We can bring the ground coat down and the cover coat up and get the two together. It is being done successfully in quite a few places.

CHAIRMAN BENNETT: It can be done, then. We will go to the second section, Enamel Firing, from questions 7, 9, 10, and 11. *Is controlled atmosphere generally adaptable.*

MR. SWEELY: Several men here have had rather wide and varied experience and have done some excellent work on this; for instance, Mr. Martin of the A. O. Smith Corporation.

CHAIRMAN BENNETT: Mr. Martin, the question, "Is controlled atmosphere generally adaptable," means, we assume, controlled furnace atmosphere.

MR. MARTIN: Yes, it is generally adaptable, but of course there are practical considerations, such as mechanical considerations of the furnaces involved, which have not at the present time been answered entirely. One of the fundamental conditions, of course, is to arrange the furnace so that an oxygen-free atmosphere can be maintained during the fusing part of the cycle.

The enameling industry largely has favored continuous furnaces, where there is no tightly closed door covering the openings of the hot chamber. No one has yet worked out a system whereby the oxygen-free atmosphere is maintained without the use of such a door. An annealing furnace was built in Detroit some years ago. I have lost track of it, but they were going to maintain an oxygen-free atmosphere, in fact, a highly reducing atmosphere by means of a hump type. We have taken care of the problem in two ways, one by the use of radiant tubes where the oxygen-free gas is in the furnace proper, and another by the direct firing of the furnace where the controlled atmosphere is only on the inside of the large tanks being fired, the tank itself serving as the muffle. It is quiet simple to close the openings in these tanks and thereby control the atmosphere in the tank throughout the process.

In the other case, when glass coating small parts of water tanks, the tanks are not assembled at that time; the heads are glass-coated separately. There we have used a specially designed furnace and have taken care of the situation by means of opening and closing doors. A roller-hearth type of furnace, which is essentially one of continuous operation,

does have an intermittent feature which permits the opening and closing of the doors, and the atmosphere is restored each time a new load has moved into the hot zone.

MR. NORDHOLT: The question of controlling the atmosphere in a furnace hinges around the control of oxidation. That is what we want in atmosphere control. We do not know of any way of controlling the atmosphere in a continuous furnace, but it might be possible to control oxidation through additions to the frit or to the steel itself.

CHAIRMAN BENNETT: We have discussed modulated control of furnaces and the radiation pyrometer. The only question remaining in that group is: *What are the possibilities of high-frequency induction heating?*

PROFESSOR KING: Two classifications are given to induction heating, high frequency and ultrahigh frequency. The high-frequency type usually goes up to 200 or 300 kilocycles and a spark gap is used as an oscillating mechanism. The more modern development is the use of vacuum tubes going up to the order of one or more megacycles or million cycles.

The cost of equipment apparently is too great to warrant the use of high-frequency induction heating in the enameling industry. Sid McCann has done some work on this.

SIDNEY W. MCCANN: We tried induction heating on small parts. As Professor King stated, the price would be absolutely prohibitive, particularly for larger parts.

CHAIRMAN BENNETT: Section 5, Materials, from questions 34, 35, and 36. *Can the various fluorine-bearing materials be used interchangeably to give the same end product; the same question for the alumina-bearing materials.*

MR. DANIELSON: Fluorine-bearing materials can be used interchangeably only to a limited extent. We certainly cannot substitute cryolite for sodium silicofluoride and obtain the same results. They give different properties to the enamels. The same difficulties are encountered in the use of feldspar. We cannot add fluorines and calcium carbonate and get exactly the same result.

PROFESSOR KING: I cannot answer for fluorides or alumina, but I would like to call your attention to two fundamental facts. Ceramics deals mostly with incomplete reactions. That applies to enamels. The reaction in enamel is perhaps more complete than any other reaction, except glass, but the glass people do not claim to obtain complete reactions; unless an absolutely homogeneous mass is obtained we cannot achieve the same end point with different materials.

Structurally speaking, silica can be tied down pretty well. There is only one exception to what we call a tetrahedral arrangement of silica in glass. Alumina will not tie down to any one thing unless the conditions are controlled carefully. Under the strictest interpretation or classification of metal, alumina is not a true metal. It violates all the class requirements of true metals, yet it has the conditions for enamel requirements and specifications. It conducts electricity, has a truly reflection surface reaction with acids to give hydrogen, etc., but it is an anomalous metal. In freshmen chemistry, we were asked to precipitate aluminum hydroxide. It dissolved in an excess of acid or in the presence of sodium hydroxide. We called it amphoteric. Alumina will act in that fashion in both the colloidic suspension and in the crystal structure.

Three minerals have the same chemical composition. One molecule of alumina and one molecule of silica, kyanite, andalusite, and sillimanite have exactly the same composition, but each differs widely in physical, crystallographic, and optical properties. The only difference in these minerals is the arrangement with respect to alumina.

About ten years ago, I tried to make some enamels by replacing feldspar by a mixture of sodium aluminate and potassium compounds. Considerable differences in properties were found.

PROFESSOR ANDREWS: I had an interesting experience about the time cryolite became so scarce. One of my friends substituted some sodium silicofluoride for cryolite enamel. He was surprised to have a much better enamel. He said, "Why didn't somebody tell me that twenty-five years ago?" This, however, is an exception and not a common experience.

CHAIRMAN BENNETT: He did not claim it was the same enamel, did he?

PROFESSOR ANDREWS: It was better.

CHAIRMAN BENNETT: That is possible. The last part of Section V is: *Discuss the use of dehydrated borax.*

MR. DANIELSON: The softer enamels can probably be interchanged without difficulty. Everybody does it and obtains good results. On acid-resistant enamels of the dry-process type, there has been a tendency to go back to hydrated borax. The bubbling action obtained seems to be beneficial.

CHAIRMAN BENNETT: Why is it beneficial?

MR. DANIELSON: Apparently because of a stirring action. When borax is dehydrated, the batch lies more or less dormant on the floor and the same results are not obtained.

CHAIRMAN BENNETT: Section VI, the Future of the Industry, from questions 24, 25, 26, 27, and 38. *How can enameling costs be reduced to meet postwar competition?*

MR. PEARCE: We have been discussing processing, which, I think, reduces cost. I will not attempt to elaborate on it. You have covered that phase.

I want to speak about labor utilization. The proper utilization of labor will reduce costs more than processing, as important as the changes in processing are.

It divides easily into two parts, viz., (1) the physical placing of men at the proper place in the plant and seeing to it that work is brought to them and taken away as it should be and (2) the field termed "humanics." In this field, we move largely from the field of the intellect or the head into the field of the emotions or the heart. We must get a man into the notion of the will to work. Some of the underlying emotions are pretty crude and I am going to use some crude illustrations.

In Washington, D. C., they say that the only place you can obtain action is in the men's toilet. Why? Because men come there knowing what they want to do. They do it and get out.

Let us carry that a step further. You go into a toilet room and immediately put yourself into a toilet stall. You think your head dictates this action. Not at all! Your head doesn't get it; you get it in your solar plexus. Why? Because for a million years you were not taking any chances on being caught in a nonfighting position.

This is what is bothering a lot of men in industry today. Their emotions are not being played upon properly.

I disagree with Jim Lincoln. That is why he was in the main session and I on the sectional program. I do not think that the carry-home pay is all that a man works for. You, in this group, for instance, do not do all of your work because of the money you earn and take home. You do it for other reasons.

We existed in the Christian era for sixteen hundred years with practically everything being done for some other reason. That is one of the things we must get at—the emotional problems of men like those in the group at Weirton who passed out bills this afternoon. These men are not receiving a great amount of pay from the CIO for passing out bills. They are doing it for some other reason.

Any psychologist could have told us what would happen to Nikolai Lenin. Why? Because he saw his own brother hang when he, Lenin, was eighteen years of age. Look at John Lewis' history and see what happened to him as a child. The emotional drive was there. We were having lunch when he came into the cafeteria, and he moved back near the air-conditioning system. We see him there quite often. That is the trouble with Lewis. Lewis has an emotional appeal that takes a hold of people.

Handling men by educational methods on their intellect does *not* reduce costs in a plant. They will be reduced only by generating in men the desire to do a job.

CHAIRMAN BENNETT: *Review the competitive materials.* I take that to mean the materials competitive to enamel.

MR. PEARCE: The list of competitive materials is long. We will try to keep this on a lower or higher level, whichever one you say, but I am reminded of what Mark Twain used to say about a certain cat. "You should not draw a conclusion from an experience that the facts do not warrant. For instance, the cat sat down on a hot stove lid. She will never sit down on a hot stove lid again, but, furthermore, she will never sit down on a cold stove lid."

Some of us have picked up a hot stove lid, have been burned, and have dropped it. Many of the general public have done that, and they will be burned on plastics more severely after the war. They will expect too much from plastics, but they will get some things they are hoping for. Plastics is distinctly a competitive field.

I listened recently in Washington to a lecture by one of the Bureau men on plastics. After it was over, I asked him a question about the silicons. If I understand silicons, they present a big threat in plastics.

Glass will compete with porcelain enamel items, especially in the kitchenware field.

Stainless steel, aluminum. We will have all the aluminum we want, oceans of it. Magnesium is no particular threat. A lot more will be done with copper, because of the pressure of the volume of copper available. Nickel is a wonderful material to work with. It has not been used as much as it should have been. We will learn the desirable characteristics of nickel. We will not have enough tin for a long time, but a combination of tin and copper may make a fine competitive material for porcelain enamel, again in the kitchenware field.

These are just some of the competitive materials we must work with, must pay attention to. They are not fears. They are not wild uncaged animals. Some of the animals are in cages and will present no destructive competition if we act intelligently.

CHAIRMAN BENNETT: What will the public expect of enamels?

PROFESSOR KING: It has become a favorite indoor sport in recent months in some circles to say what the returned veteran will expect when he comes home. I recently sat in on a conference in which nearly everyone seemed to know exactly what the returned veteran was going to do. I suspected that they were putting words in his mouth. This suspicion was confirmed a few days later when I read a statistical analysis of a study that was made of the intentions of the returned veterans to go to college. Only 4% of the opinions could be depended upon.

We cannot say what the public will expect of enamels any more than we can say what the veterans will expect when they come home.

Charlie Pearce perhaps can tell us more than anyone else. He has studied the market and is studying the market, but I would venture the opinion that the public will take the enamels we educate them to expect.

MR. PEARCE: The public will expect a lot of things. Some say of enameled products, "Are they chip-proof?" They have always expected them to be chip-proof. They never have been. When one promising company said, "We have a chip-proof enamel," it got to the Federal Trade Commission before they were proved to be wrong officially. They were proved to be wrong in experimental data every day by the people who used their enamel. Good as it was, it was not chip-proof.

The public is expecting superlatives in enamel. They will not get them.

This morning I spoke about volume. The porcelain enamel industry never has faced a more brilliant future than it does today. V plus 2 will see some competition. Certainly up to that time we shall have every bit of business we want.

We must also study some other factors that affect the market for porcelain enamel products, e.g., the change in the average age of Americans. The medical profession has pushed up the average age of not only Americans but the entire world. The average age of an individual today is double the average life expectancy in 1851 when insurance companies compiled the American mortality tables. What will that do to our product? Here is a good example. If any of you are making bottle sterilizers, cut it out. Start making bed pans. You are in a better market.

CHAIRMAN BENNETT: The last question in Section VI is: *What new fields might there be, and would the architectural field be broadened by certain standardizations in technique?*

PROFESSOR KING: A few years ago, I did some work for the Porcelain Enamel Institute on standardizing enameling specifications. I have always felt, and have preached it continually with little response, that standardization in construction was essential, particularly of a good method of construction.

In the last four years, I have run some exposure tests on caulking compounds and recently reported the results. It was surprising how few stood a four-year exposure satisfactorily. So, from the standpoint of standardization, construction is most important. If it is put under the heading of standardization, standardization on caulking compounds, that can do the job. I have not kept up with this much in the last four or five years, so I have no knowledge that further standardization has been done.

I will pass the buck back to Charlie to finish the question.

MR. PEARCE: It is a long question and it is getting late. The possibilities in the field of building uses of porcelain enamel are certainly great. This industry moves largely in agreement with the building industry because most of our products can go into the building industry, essentially in the kitchen, bathroom, and laundry. They must go into the laundry a lot more than they have in the past.

If we are going to move in those fields, we must certainly be keyed to the building industry. It, as well as we, has set up specifications in some fields, and some of the ceramic products are not standardized to the measuring point. Enamel is standardized. We must have standardized methods of doing things, but do not expect them tomorrow afternoon. They will come through a long process of growth.

CHAIRMAN BENNETT: *What incomplete data are outstanding? That is, have papers been presented which started some interesting investigations that have never been finished? Have they progressed, but not to the point of publication? Are many data outstanding?*

PROFESSOR ANDREWS: The corrosion-resistant field for porcelain enamels has not been worked on as much as it should be. These enamels can be used in a great many places where they are not used now as corrosion-resistant materials. Also, a lot of work is being done in the country on high-temperature ceramic coatings. Maybe we do not call them porcelain enamels, but they are similar. Steel and ordinary iron can be used at much higher temperatures than ever before because of these coatings, and there is a great future possibility for the development of ceramic coatings for the use of ordinary iron instead of special steels to prevent corrosion at higher temperatures.

CHAIRMAN BENNETT: We are through with the questions. Every question sent in has been incorporated in the body of questions and reviewed. We are now ready for questions from the floor.

MR. DANIELSON: I would like to add one thing to the point about costs. Mr. Pearce has very well dwelt on the point of labor costs, but inserted in this question is a sentence that has been overlooked. Much attention should be given to cheaper and at the same time better enamel. Do we really sit down and think it over? After all, an eighth of a pound of enamel costs only a cent, or maybe three-quarters of a cent. If the enamel costs can be cut, they certainly cannot be cut a great deal. Production will be limited. We must look at the other end of the field, if we really want to reduce cost.

Labor in application, processing, and firing is the item that really increases the cost. It adds up to 10 or 15 times the cost of the enamel. We have always gone to the wrong point when asking whether cheaper enamel could be made.

MR. ROTH: The question of mixing and the size of raw materials was passed over rather lightly. At the last session meeting last fall, the Owens-Illinois Glass Company presented some work on mixing that they are still carrying

out. They varied the size of three raw materials, sand, calcium carbonate, and soda ash. They sometimes obtained quite a difference when they varied the size. I think that the larger-grained sand was better than the small. They evidently still do not know the best grain size for glass, and they have far fewer ingredients than we have.

Consider the size of quartz. If we get the batch in some of the nitrate of soda and soda ash melts down, is it better to have the smelt over the fine material or would it be better to have the coarser?

Mr. Danielson mentioned titanium oxide lumps which also stay as they are. Would that be true of sodium antimonate and barium carbonate? What is the difference in the size of feldspar and silica value? If it is coarser, will the alkali fuse with it more quickly or would it be otherwise?

MR. DANIELSON: We have made careful tests of feldspar at various degrees. Normal feldspar is called 140-mesh, but it is actually a lot finer. Practically all of it will go through 200-mesh. Feldspar ground relatively coarse worked just about as well as a finer material.

Whether that would apply to all other materials I cannot say.

E. C. GREENSTREET: Has any work been done on the use of water in enamel batches?

MR. SWEELY: The reported work on that question is confined to one of the meetings of the Institute. I think that Mr. Morrison of the Illinois Water Treatment Co., Rockford, Ill., reported on the results of the use of the treated water (which approaches distilled water) in the plant of the Roper Stove Company. That same year, Mr. Shands of that Company added something to it. I can only refer you to that year's Forum publication.

CHAIRMAN BENNETT: Did you mean water?

MR. GREENSTREET: I meant water in the frit batch.

CHAIRMAN BENNETT: In the dry process?

MR. GREENSTREET: In any process, in the smelting process.

MR. SWEELY: I have no information.

MR. GREENSTREET: I asked the question because some work has been done in the past in the glass plants. They added water to their glass batch to obtain a more stable mixture.

CHAIRMAN BENNETT: Does that not tie in with hydrated borax in the batch?

MR. DANIELSON: That may be to stop the dusting of soda ash.

MR. GREENSTREET: It goes further than that.

W. KREIDL: I would like to answer that question. It refers to the work of Professor Turner in England on wetting glass batches. He found that a substantial increase of melting velocity increased by averages about 10 to 20 per cent reduction of total melting time.

H. C. ARNOLD: How was the water added, as a spray?

MR. KREIDL: It was sprayed on and mixed at the same time.

E. C. AYDELOTT: I would like to ask Mr. Pearce to elaborate on his statement that we need to appeal to the emotions of our workers to get them to produce more, or at least produce what they should produce, as compared with Mr. Lincoln's philosophy that the way to get them to produce more is by showing them that they can take home more money by producing more work.

MR. PEARCE: That has to do a lot with the treatment of men in a plant. I do not want to make a public statement here about the situation at Weirton, W. Va., but I think I could describe in a perfectly logical sequence what has gone on in the town and what has led to the trouble. It is a good town. If we studied the history of Weirton from the time it was founded and the handling of men in that plant, we could follow certain psychological laws and see they were bound to have trouble. Certain things happened during the depression which are in reverse today; men are taking the position management took in 1933. We all know what happened. There are scars in the emotions of many men that will not wear off. We must work around them in handling these men. Many times we will find that home trouble is creating the problem.

Money will not cover that up. Offer them big rates of pay and they will still kick back when they get the chance.

Just one more thing about costs. The glass industry pulls a ton of glass through a glass tank, makes bottles, and packs them in corrugated boxes for less than $30 a ton.

MR. ROTH: Is Mr. Pearce correct on the $30 a ton? Is it not a little higher? Does that include research for the overhead work?

MR. BRYANT: Does the firing cycle cause scumming?

MR. NORDHOLT: Years ago, when the antimony-free enamels first came out, if we underfired one of them, we could not get the gloss back by refiring.

MR. BRYANT: That is my idea, too. If antimony-free enamels are held at a low temperature for certain lengths of time and are finally brought up, a cycle can be produced.

MR. NORDHOLT: Is it fair for the panel to ask a question? Some of the paint or chemical companies are introducing a material called vitreous enamel, which, I understand, contains some quartz and some other composition and sodium silicate. They apply it by spraying and dry it around 350°. They claim in their advertising that it is vitrified. Has anyone run into it and what is going to be the upshot of it?

MR. PEARCE: I want to call your attention to the Tuttle Cement Case, decided by the Federal Trade Commission in 1935, which definitely stated that those products were not vitrified and had no relation to porcelain enamel. The Federal Trade Commission eventually will take action in every one of those cases. The case before the Commission (they held hearings two months ago) is the case of the Porcelainize. This seems to be a diatomaceous earth and oil of some kind which we used for polishing the surface of a lacquered car. The company calls it Porcelainize. The Porcelain Enamel Institute took it to the Federal Trade Commission, who tried to throw it out. The Trade Commission probably will decide in our favor. These products are not vitrified or porcelain enamels, and I do not think the term will stand.

R. E. MULLADY: Returning to the question on dry pickling, I did not hear the name of the gas that Mr. Weller started with.

CHAIRMAN BENNETT: Who was the expert?

A VOICE: Anhydrous hydrogen chloride.

A VOICE: How could that be patented?

MR. MOORE: Acid anneal has been used for years. The British have used a lot of it and everyone here probably has used it at sometime or other. Did he not say that this process was patented?

PROFESSOR ANDREWS: I read some material on that last night and I am pretty sure dry chlorine was added.

CHAIRMAN BENNETT: Porter, you think so, too, don't you?

MR. PORTER: Yes.

PROFESSOR ANDREWS: They must dry the water out of combustion products, mix them with the chlorine and additional raw gas, and run the mixture (HCl, CO, CO_2) into the chamber where the pickling is done.

MR. ROTH: I think that the article is in *Iron Age* and mentioned anhydrous hydrochloric acid. Surface combustion enters into it.

CHAIRMAN BENNETT: That is apparently something we need to know. We still have some business to transact, to turn this meeting over to the new chairman. Do not leave until the end.

MR. ARNOLD: I would like to obtain the name of the electrostatic manufacturer.

MR. SWEELY: I believe it is the Harper J. Ransburg Company, Indianapolis.

CHAIRMAN BENNETT: Nick Carter has the letter in his files.

Chairman Bennett turned the meeting over to H. D. Carter.

CHAIRMAN-ELECT CARTER: I want to thank the members of the panel for cooperating so generously and I certainly appreciate the cooperation that I received from the men contacted in the field when assembling the program.

The meeting adjourned at 5:00 p.m.

NOTES FOR CERAMISTS

SOUTHERN CALIFORNIA SECTION

A meeting of the Southern California Section was held June 5, 1944, at the Mayfair Hotel, Los Angeles, Calif. Our attendance was about fifty-four.

We were pleased to have as guests Howard L. Haney of the Harshaw Chemical Co., Cleveland, Ohio, and William V. Knowles of the Titanium Alloy Mfg. Co., Niagara Falls, N. Y. —GUY WURTSBAUGH, *Secretary*

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UNIVERSITY OF ILLINOIS NEWS

R. L. Cook, associate in the Department of Ceramic Engineering, at the University of Illinois, Urbana, Ill., received the degree of Doctor of Philosophy in Ceramic Engineering in June. His thesis was on the "Study of the Durability of Porcelain Enamels" and was reported on in part at the Pittsburgh Meeting of The American Ceramic Society.

C. H. Commons, Jr., was granted the Professional Degree of Ceramic Engineer in June. Mr. Commons was graduated from the Department of Ceramic Engineering in 1929, was formerly with the Titanium Alloy Manufacturing Company, and is at present with the Army Ordnance Division. The award was based partially on the outstanding work done for the Ordnance Division and also on other papers which were submitted as thesis material.

Two Bachelor of Science degrees were granted in June, one to Raymond Moore, who has been employed by the Corning Glass Works, and one to Gordon H. Johnson, who is doing special research work in the Department of Ceramic Engineering.

DR. CONDON OF WESTINGHOUSE HONORED

Edward U. Condon, associate director of the Research Laboratories for the Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa., has been elected to membership in the National Academy of Sciences, membership in which is based upon outstanding contribution to the field of science.

The National Academy of Sciences was incorporated by Congress to report on matters in science or art whenever called upon and often has been of service to the United States Government. Headquarters are in Washington, D. C.

The total membership of the Academy now is only 352.

Is Theoretical Physicist

Dr. Condon is widely recognized as an outstanding research worker in the field of theoretical physics. His best-known contribution in this field is the interpretation of the phenomenon of spontaneous emission of alpha particles from materials such as radium.

This theory was developed jointly with R. W. Gurney, now of the faculty of the University of Bristol, England, when both men were at Princeton University in 1928. The deeper understanding of radioactivity provided by this work paved the way for interpretation of much of the more recent work in nuclear physics which has occupied the center of attention among physicists.

Worked with Atom Smasher

Dr. Condon conducted extensive research in atom smashing and has made a thorough study of the phenomenon of atomic power.

Two of Dr. Condon's scientific works are "Quantum Mechanics," written jointly with P. M. Morse of the faculty of the Massachusetts Institute of Technology, and "The Theory of Atomic Spectra," in collaboration with G. H. Shortley of the faculty of Ohio State University. He collaborated with J. Franck of Johns Hopkins University on studies in molecular structure leading to the formulation of the Franck-Condon principle.

He is a native of Alamogordo, New Mex., attended high school in Oakland, Calif., and was graduated from the University of California in 1924 with highest honors. Two years later, he received the degree of Doctor of Philosophy from the same institution.

Dr. Condon joined the Westinghouse organization in 1928 after having taught at Columbia and Princeton Universities.

ENAMELED UTENSIL TECHNICAL COMMITTEE

The second general meeting of the Technical Committee of the Enameled Utensil Manufacturers' Council was held in the Department of Ceramic Engineering at the University of Illinois, Urbana, Ill., June 12, 13, and 14.

At the meeting, the technical men from the member plants were given a summary of the results of work done on the cooperative project which is sponsored by the Council at the University.

The complete program for the meeting was as follows:

Monday, June 12

MORNING: Registration at the Ceramics Building on the campus.

1:00 P.M.: Group luncheon at Kammerers on Lincoln and Nevada, Urbana, Ill.

2:00 P.M.: Welcome to the University of Illinois by DEAN M. L. ENGER.

2:00 P.M.–5:00 P.M.: (1) Review of test results, "Miscellaneous Shapes and Two-Quart Pudding Pans" by F. A. PETERSEN, Department of Ceramic Engineering, University of Illinois.

7:00 P.M.: Group dinner at the Urbana-Lincoln Hotel. Guest speaker, I. J. FAIRCHILD, National Bureau of Standards, Washington, D. C., "Why Have Kitchenware Standards?"

Tuesday, June 13

9:00 A.M.–12:00 M.: General Session.

(2) "New Developments in the Enameling Industry" by A. I. ANDREWS, Department of Ceramic Engineering, University of Illinois.

(3) "Chemical Durability of Enamels" by R. L. COOK, Dept. of Ceramic Engineering, University of Illinois.

(4) "Enamel Composition" by A. I. ANDREWS.

(5) "Enamel Clays" by R. L. COOK.

12:00 M.–1:30 P.M.: Group luncheon.

1:30 P.M.–5:00 P.M.: Session on Enamel Defects.

(6) "Relation of Chipping to Enamel Properties" by F. A. PETERSEN.

(7) "Tearing of Enamels" by A. I. ANDREWS.

(8) "Hairlines in Enamels" by F. A. PETERSEN.

(9) Movies showing development of enamel defects by A. I. ANDREWS.

Wednesday, June 14

9:00 A.M.–12:00 M.: Round-table discussions (questions answered which had been submitted by men in the industry).

12:00 M.–1:30 P.M.: Group luncheon.

1:30 P.M.–5:00 P.M.: Private conferences with A. I. ANDREWS and F. A. PETERSEN. Session on enamel formula calculations conducted by R. L. COOK.

I. J. Fairchild, the guest speaker at the banquet on Monday evening, is chief of the Division of Trade Standards at the National Bureau of Standards, Washington, D. C., and has been connected with this work for the past twenty-two years. In his talk, he pointed out some of the many advantages of setting up commercial standards, and showed how the commercial standard, CS 100–42, can be of great value to the industry.

On Wednesday morning, A. I. Andrews, C. M. Andrews, D. G. Bennett, F. A. Petersen, and R. L. Cook took part in the round-table discussion along with all of the men present. Much interest was shown in this part of the program, and some good discussions were obtained.

Technical Group Meeting of Enameled Utensil Manufacturers' Council

First Row: **H. H. Maas, H. M. Zimmerman, L. Ashby, Leas Housley, L. E. Aarnink, A. J. Vollrath, and H. Boyer.**

Second Row: **R. L. Cook, F. J. Hodnick, E. C. Dexheimer, J. D. McQuade, Paul Huppert, Bob Gorby, and D. G. Bennett.**

Third Row: **O. E. Mulvane, C. F. Schiller, G. A. Foehse, P. A. Mallonn, H. C. Arnold, S. A. Chambers, and C. M. Andrews.**

Fourth Row: **F. A. Petersen, W. N. Lybarger, E. A. Schwarz, E. H. Kelsey, B. S. Kirk, and A. I. Andrews.**

PEMCO'S ONE-COAT WHITE, DIRECT-TO-STEEL PORCELAIN ENAMEL FINISH

After more than twenty years of laboratory and field work, the Pemco Corporation, Baltimore, Md., has announced the development and release of the first commercially successful one-coat white, one-fired, direct-to-steel porcelain enamel.

This new product has been appropriately named Mirac, "a miracle of progress" in the enameling industry. The possibilities of this new product are unlimited, for it is truly the answer to the enameler's dream.

...47th Annual Meeting...
The American Ceramic Society, Inc.,
Hotel Statler, Buffalo, N. Y.,
April 15-19, inclusive, 1945

All Divisions Meeting Simultaneously

Fellows, Institute of Ceramic Engineers,
Ceramic Educational Council,
Ceramic Camera Club

JAMES EDWARD HANSEN*

New Editor of *The Enamelist*

J. E. Hansen, editor of *The Enamelist*, is well known to most of our readers. In addition to the present new assignment, Mr. Hansen, or "Ed," as he is known in the field, will continue with his duties as the Director of Service for the Ferro Enamel Corporation.

J. E. Hansen

Mr. Hansen is a graduate in chemistry from the University of Illinois. He spent six years at the Mellon Institute of Industrial Research, carrying on research and development work on porcelain enamels and joined the Ferro Enamel Corporation in 1926.

He became Director of Service for the Company in 1935.

Ferro, at the beginning of the war, asked Mr. Hansen to help design and build and to take charge "for the duration" of the new plant housing its Powdered Metals Division. This plant, since late in 1942, has been turning out a large volume of war materials for the Government.

A little later on, Mr. Hansen became manager of another of Ferro's plants turning out a war product. This position he relinquished recently, in favor of management by a "peacetime" group.

Conducted Short Course

Many of our readers will remember that between the years of 1926 and 1936 Mr. Hansen conducted a series of "Short Courses for Porcelain Enamelers." These were held annually and were attended by men from all branches of the industry, many of whom are now in leading executive positions. The "Short Course" was renamed the "Ferro Forum for Porcelain Enamelers" in 1930, and in 1937 the project was taken over by the Porcelain Enamel Institute, who, since then, with the exception of the war years, has conducted similar courses each year.

Mr. Hansen is author of "The Technique of Vitreous Enameling," published in 1927 by the Enamelist Publishing Company, "The Advanced Technique of Porcelain Enameling," published in 1932, and is editor of the volume, "A Manual of Porcelain Enameling," published in 1937.

He has been a frequent contributor to this magazine, *The Journal of The American Ceramic Society*, and other ceramic publications.†

Prominent in A.C.S. and P.E.I.

He is an ex-trustee of both The American Ceramic Society and the Porcelain Enamel Institute and for several years has been a member of the Program Committee of the Porcelain Enamel Institute Forum Committee.

Mr. Hansen will also be remembered by many porcelain enamelers as having had charge of the Ferro Enamel Corporation's "Little Red Schoolhouse on Wheels," offered in 1938. By this method, visits were made to plants in the industry, where lectures on porcelain enameling were given and movies shown to interested groups.

* Reprinted from *The Enamelist*, **21** [9] 26–27 (June, 1944).

† For a complete list of Mr. Hansen's publications, see *Bull. Amer. Ceram. Soc.*, **19** [6] 237 (1940).

CERAMIC ASSOCIATION OF NEW JERSEY

The Ceramic Association of New Jersey held a successful summer meeting at the Trenton Country Club, Trenton, N. J., Tuesday, June 20, 1944. The registration totaled close to one hundred persons from New Jersey and nearby states. Charles S. Pearce, the new Associate Secretary of The American Ceramic Society, was among those present.

Except for a brief business meeting, the entire morning was devoted to a technical session on the subject of silicosis and aluminum therapy, featuring two interesting speakers, Dr. Dudley O. Irwin, Medical Director of the Aluminum

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444 Lake Shore Drive, Chicago, Illinois 550 South Flower Street, Los Angeles

Research Laboratories, Aluminum Company of America, Pittsburgh, Pa., and Dr. J. W. G. Hannon, of Washington, Pa., Assistant Medical Director, McIntyre Research, Ltd., Toronto, Canada.

Dr. Irwin discussed the physiology of the respiratory system and explained how the human body combats the effect of dust particles entering the lungs. In comparing the effect of various kinds of dust particles on the interior surface cells of the lungs, he pointed out the reasons for the difficulty in eliminating quartz particles and their effect on the "dust-removing" cells. A quantitative method of determining the quartz present in the lungs by the X-ray diffraction technique was described. Extensive research work on the cause and possible cure of silicosis has been initiated as a result of the quartz dust problem encountered in the Canadian gold mines. Conducted mostly on animals, this research has revealed that metallic aluminum dust has a remarkable effect in preventing the development of fibrosis of the lungs resulting from the presence of quartz particles. Dr. Irwin explained the reason believed for this beneficial effect of aluminum and described an apparatus developed for producing aluminum dust and its inhalation by human beings. This treatment has shown favorable results in Canada where it was introduced in the gold mines several years ago.

Continuing with the subject, Dr. Hannon discussed the general problem of dust hazards in industrial plants, emphasizing ceramic operations which involve dust-containing free silica. The importance of dust concentration and elimination, as well as frequent X-ray chest examinations, was stressed. Dr. Hannon described the aluminum therapy treatment now in use in various parts of the United States for treating persons exposed to dust hazards. He cited several case histories of individuals afflicted with an advanced stage of the disease and showed how aluminum therapy resulted in a marked improvement in their condition, reflecting not only in their improved physical state, but also in their capacity for work.

REMMEY LABORATORY KILN No. 2150

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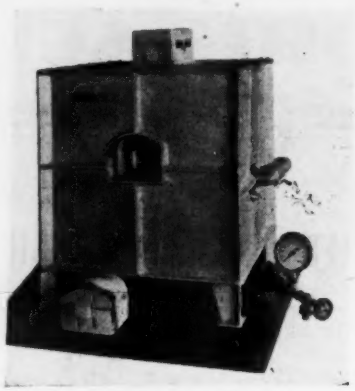


FEATURES

- May be Held at Any Temperature from 1200° F.to 3200°F.
- Single Valve Control
- Uniform Temperature
- No Stack Required
- Numerous Uses
- Two New Refractories Used
- Three Piece Lining
- High Thermal Efficiency
- Welded Steel Case
- Use either City, Natural or Propane Gas

Dependable Refractories

RICHARD C. REMMEY SON CO.

Hedley Street and Delaware Ave. PHILADELPHIA 37, PA.

The afternoon, the time was available for relaxation and informal get-togethers. A program of sports, including a golf tournament and a softball game, attracted a good number. An outdoor picnic supper in the grove concluded the events of the day.

PAUL EDGAR WILLIAMS

Director of Jefferson College Joins Fiberglas Corporation

Paul Edgar Williams, director of Jefferson College, St. Louis, Mo., for the past ten years, has joined the Owens-Corning Fiberglas Corp., Toledo, Ohio, as director of the Company's newly expanded education program.

The program, an extension of a training program that has been in effect in the Fiberglas factories for several years, is designed for both new personnel assigned to positions of responsibility in sales, service, manufacturing, research, and other departments and present employees holding similar positions who will benefit from a broadened understanding of Company policies, products, markets, and application requirements.

Paul Edgar Williams

Dr. Williams brings to his new positon not only a broad experience in the educational field, but a firsthand knowledge of the personnel-training problems of industry. As director of Jefferson College, he organized, in cooperation with local business leaders, a system of education whereby students alternated study with work in industrial establishments. Since 1940, he has been active in organizing training programs for civilian aircraft pilots, for Army Air Forces cadets, and for civilians seeking to qualify for positions in essential industries. In the three fields, approximately five thousand persons have trained at Jefferson College.

Before his work at Jefferson, Dr. Williams was dean of the Junior College, Fenn College, Cleveland, Ohio.

While in Cleveland, he was active in the work of the Adult Education Council, produced a series of radio broadcasts on vocational guidance, and organized several vocational guidance conferences. Before deciding upon a career in education, he served as an employee of the Wheeling and Lake Erie Railroad and as a member of the personnel department of the Westinghouse Electric & Mfg. Company.

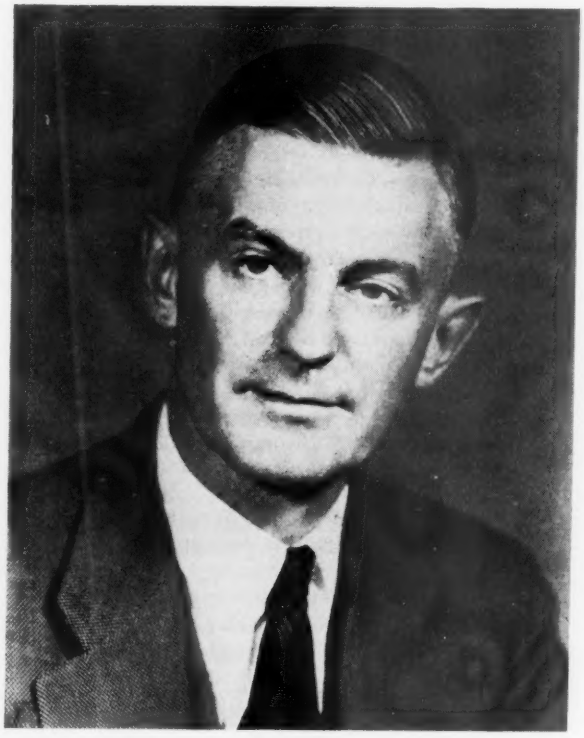
Dr. Williams was born in Wellington, Ohio, and attended the public schools there. He took his A.B. degree at Ohio Wesleyan University, Delaware, Ohio, and his M.A. and Ph.D. degrees at Western Reserve University, Cleveland, Ohio.

GLASS IN THE POSTWAR PICTURE

Lufkin Address

Garland Lufkin, vice-president and general manager of the Planning and Research Division of the Owens-Illinois Glass Company, spoke to members of the Bridal Business Clinic sponsored by *Bride's Magazine* at the Ritz-Carlton Hotel, New York, N. Y., June 15 and 16.

His address, "The Future of Glass and Its Flexibility in the Postwar Picture," is summarized as follows:



Garland Lufkin

With a multitude of other products, glass has gone to war. In lenses for optical instruments, electronic tubes for radio and radar, fireproof thermal and acoustical insulation for ships and planes, electrical insulation, lightweight structural shapes of Fiberglas and plastic for airplanes, containers for food and medicinal products, transparent noses for bombers and bulletproof windshields for fighter planes—in these and hundreds of other uses glass is playing a vital part in the winning of the war. On the home front, glass has helped to relieve the shortage of metals and other materials in many ways.

After the war, flat glass, the high-test safety glass used for automobiles, buses, railroad cars, etc., will be used extensively. Improvements can be expected in this product which has already saved thousands of lives. The same type of glass, but with heat-resistance reinforcements, has been used by the Libbey-Owens-Ford Glass Company to build a model kitchen which is currently on tour of the country in leading department stores. This kitchen will aid the housewife by lightening her tasks and providing a cleaner place in which to work.

Another aid to the housewife in postwar times will be the improved quality of glass containers. Substantial reductions in the weight of containers permitted by increased strength and better design, coupled with improvements in the technique of automatically handling glass in the packaging plants, have broadened the use of such articles.

Not so long ago, a jar holding one pound of coffee weighed 23 ounces and was processed at a relatively slow rate, with considerable manual labor. After the war, a jar of the same capacity will weigh less than one half the original weight and will move at high speed along the filling line.

A method for setting up interior wall partitions of glass block with special wooden strips has been developed. It eliminates the expense of mortared joints and permits dismantling and moving if desired. Foamglas, developed by the Pittsburgh Plate Glass Company, is another interesting new glass product. It is made by incorporating materials into finely ground glass which will develop gas when the mixture is melted. The resulting product consists of a multiplicity of minute air cells protected by thin walls of glass, like a mass of extremely fine glass bubbles all welded together. The product can be cut with an ordinary carpenter saw, is lighter than cork, and can be used for insulation with the increased advantage of being fireproof.

Fiberglas, glass in fiber and filament form resembling wool, has many peacetime uses, such as insulation for ranges, refrigerators, water heaters, and electric toasters.

Within the realm of possibilities for the near future are plastic furniture, luggage, and numerous household appliances, all reinforced by glass. Fireproof decorative fabrics will be used in public places and in homes to eliminate a frequent fire hazard at its source. The practicability of this use has been proved through employing Fiberglas fabrics as shades on million-candle-power magnesium parachute flares to protect the vision of our airmen flying above them.

In the field of commercial glassware or inexpensive everyday household tumblers, the development of heat-treated glassware offers much promise. This process is similar to heat-treated flat glass and was being applied to tumblers at the start of the war. Although heat-treated tumblers are not unbreakable, they have a longer life than ordinary tumblers.

Today commercial stemware for restaurants, cocktail bars, etc., is being made by automatic, high-speed methods that are economical, but sacrifice practically nothing in quality and appearance of the product. Styled correctly, this type of stemware offers great possibilities in the popular-price brackets for household use.

PRODUCERS' COUNCIL URGES ADOPTION OF MODULAR DESIGN

Architects and engineers are urged by The Producers' Council, Inc., to help reduce postwar building costs by adopting dimensional coordination through modular design of buildings of all kinds to be built after the war.

In a letter addressed to ten thousand designers, James W. Follin, The Council's managing director, stated that architects can give valuable impetus to the project by notifying manufacturers of building products that there will be a demand for materials and equipment produced with coordinated dimensions.

"Since the cost of construction after the war is expected to be at least 30 per cent higher than prewar costs, owing to the rise in the general level of wages and commodity prices, it is imperative that the construction industry take advantage of every desirable economy as a means of counteracting the price increases.

"By designing projects on the modular basis, in accordance with the principles of dimensional coordination, architects will save time in layout and detailing and in their supervision of the construction. In addition, the system of coordinated dimensions means better quality in construction because less is left to chance when the building products are fitted together on the job.

"Perhaps the greatest saving will result from the fact that, when materials and equipment are made with adequate regard for the dimensions of other products with which they must be combined in various types of structures, there will be less waste of materials and less time lost by workmen in cutting and fitting.

"Additional economies will result in the manufacture of building products, since producers of materials and equipment will have fewer sizes to manufacture and keep in stock, and the smaller number of sizes to be made will sermit a greater degree of mass production, which brings a ptill further reduction in cost.

"Manufacturers of structural clay products already have agreed to adopt coordinated dimensions for postwar brick and tile. Having approved modular masonry based on the standard four-inch module, they thus have provided the first step for coordination of related products. Manufacturers of wood and metal doors and windows are intensively studying sizes for coordination, and studies are under way to develop suitable dimensions for other building materials and equipment."

Active work to encourage the industry-wide adoption of this project was begun five years ago, through the joint efforts of The American Institute of Architects and The Producers' Council in sponsoring American Standards Project A62,* and the plan was singled out for major emphasis in The Council's Platform for Postwar Construction.

* See *Bull. Amer. Ceram. Soc.*, **22** [12] 417–18 (1943) and **23** [1] 28–31 (1944).

GLASS-TANK REGENERATOR REFRACTORIES*

By C. A. Brashares

I. Introduction

The extremely wide range in the types of refractories used in glass-tank regenerators is particularly interesting in view of the more or less fixed theories of the properties which are most important in a checker brick.

II. Choice of Refractories

Experience must necessarily dictate the refractory providing the best over-all utility for each section of a given regenerator. In properly evaluating the performance of a particular refractory, of first importance is the establishment of the causes which have made replacement necessary. After this is done and a change is desired, another refractory may be chosen, the properties of which provide increased resistance to the destructive influences.

We might to advantage briefly review the more generally used types of refractories.

(1) Silica Refractories

High-quality silica brick have the following approximate chemical analysis: SiO_2 95.8, Al_2O_3 0.9, Fe_2O_3 0.9, and CaO 2.1%.

Silica brick have been used successfully in the regenerator checkers of glass tanks melting borosilicate glass. In these tanks, operating at high temperatures, the conditions which the regenerator refractories are called upon to resist are very severe. Silica brick used as checkers tend to be consumed gradually and uniformly. In tanks melting other types of glass and where there is a tendency for excessive build-up on the refractories and clogging of the checker openings, silica brick may also merit consideration because of this ability to keep free from accumulation. The high mechanical strength of silica brick to within a relatively few degrees of actual fusion and their high thermal conductivity are properties which are important in checker brick. The use, however, of silica brick in glass-tank regenerators is rather limited.

* Presented at the Autumn Meeting of the Glass Division, The American Ceramic Society, Inc., Uniontown, Pa., September 15, 1943. Received March 24, 1944.

(2) High Heat Duty Fire-Clay Refractories

This type of refractory is by far the most widely used in glass-tank regenerators. A typical analysis of a high heat duty fire-clay brick is as follows: SiO_2 52.7, Al_2O_3 + TiO_2 42.9, Fe_2O_3 2.1, CaO 0.3, MgO 0.4, and alkalis 1.6%.

High refractoriness, high density, low porosity, and volume stability at high temperatures are important properties for this service. To secure these properties in high heat duty fire-clay brick, either the vacuum power-press process or the deaired, extrusion process is usually employed in their manufacture, and the firing treatment is such that a hard-burned product is secured.

In regenerators in which operating conditions are most severe, the use of high heat duty fire-clay brick may be limited to the lower checker courses.

(3) Superduty Fire-Clay Refractories

The superduty fire-clay brick have a slightly higher alumina content than high heat duty fire-clay brick and a margin of superiority in refractoriness. These properties are of considerable advantage in regenerator refractories. In addition to the superduty fire-clay brick, there are also the special hard-burned or so-called "double-burned" superduty refractories. These brick are made from the same constituent materials as the regular superduty fire-clay brick, but, by virtue of the harder burn given to them, their porosity is lower and their stability at high temperatures is greater. The margin of quality offered by both the regular and the special hard-burned superduty fire-clay brick has resulted in their increasing use in glass-tank checkers. To balance the life of the checkerwork, it may be desirable to use superduty fire-clay brick for the upper courses and high heat duty fire-clay brick for the lower courses where conditions are less severe. To secure the most desirable properties in superduty fire-clay brick, they must be formed under heavy pressure such as can be applied by the power press.

(4) High-Alumina Refractories

This type includes alumina-silica refractories containing 50% or more of alumina. The classes which have been

most widely used in glass-tank regenerators are the 50 and 60% and in certain applications a special 60% and the 90% alumina refractories in which corundum is used in the brick mixes.

Brick of the 50% alumina class are usually made from diaspore clays. Their utility for checker service is due to their chemical composition, high refractoriness, and strength and stability at high temperatures. Their porosity is not usually as low as that of superduty fire-clay brick. Depending upon individual conditions, their higher alumina content may or may not more than compensate for their slightly higher porosity. At the present time, brick of the 50% alumina class are priced the same as the special hard-burned superduty fire-clay brick. This point is sometimes lost sight of in the consideration of the 50% alumina refractories, and the margin of quality so far as refractoriness and alumina content are concerned is not always utilized to the fullest degree.

The 60% alumina class includes diaspore and kyanite brick as well as brick containing fused alumina. These are of course more refractory than brick of the 50% alumina class. To illustrate the increased refractoriness accompanying the increase of 10% in alumina content, the P.C.E. of the 50% alumina class is given as cone 34–35, equivalent to a temperature of 3223°F., as against a P.C.E. of cone 36–37 for the 60% alumina refractory, which is equivalent to a temperature of 3300°F.

Refractories of the 70% alumina class are not generally used for glass-tank checkers. They have been tried and at times used, but for the most part they have cracked and shelled off in service. Some investigations have been made of this action, such as that reported by Thompson and Rexford.[1] They found that the separated slab was composed of nephelite with smaller amounts of corundum and mullite and that reversible thermal expansion of the slab was about double that of the less affected portion of the brick. This difference in expansion characteristics between the two portions of the brick provided a reasonable explanation of the cause for the parting observed. Although the particular brick studied by Thompson and Rexford was of the 60% alumina class, a similar condition has been observed in some instances with the brick of the 70% alumina class.

In other cases, particularly with brick of the 70% alumina class, there has been a shrinkage of the exposed surfaces and some indication of the separation of corundum. This shrinkage has often resulted in the spalling or parting of the exposed faces. The separation of corundum from the compounds present in the original brick would normally result in a contraction and could possibly account for the spalling observed.

With the special refractories of the 60 and 90% alumina classes containing corundum, good resistance to spalling conditions has been experienced generally. The corundum present is largely due to the inclusion in the brick mix of substantial percentages of electrically fused alumina. Corundum is of course extremely resistant to the attack of alkaline dusts, and, possibly by reason of its presence as a substantial constituent, there is less alumina present to form any large amounts of additional corundum with the resultant possible volume changes. The refractoriness of a high-alumina brick is approximately proportional to its alumina content. The 90% alumina brick have a P.C.E. of cone 39–40, equivalent to a temperature of 3407°F. These brick are extremely strong under load at high temperatures and have high thermal conductivity. They are heavier than high-alumina brick of the other classes.

(5) Magnesite Refractories

Magnesite brick, of both the hard-burned and the chemically bonded types, have been used in glass-tank regenerator checkers. Being chemically basic and of high unit weight and possessing high thermal conductivity, they would appear to be unusually well suited for the service. Other physical properties, however, tend to limit their use as checkers; e.g., the relatively high thermal spalling tendency of hard-burned magnesite brick may be a limiting factor. The chemically bonded magnesite brick are considerably more resistant to spalling. These brick, however, do show some diminution in mechanical strength, within certain temperature ranges. As shipped, they are very strong and even after being heated to high temperatures their strength is usually entirely adequate. After heating at intermediate temperatures, especially within the range 1800° to 2000°F., the chemically bonded magnesite brick developed to date tend to be weaker. This may limit their use, particularly where relatively low temperatures prevail, as, for example, in the gas checkers. Another property of chemically bonded magesite brick, which in some instances has retarded their use in this application, is the relative lack of strength they possess under load at high temperatures. Where checkers are built in a fairly high setting and the temperatures are high, such brick have tended to subside. As a rule, after having been in service they do not possess sufficient strength to permit any substantial percentage of salvage. They have demonstrated, however, their ability to keep free from dusts and deposits and thus they materially retard clogging.

Hard-burned magnesite brick have been tried but the results obtained have not encouraged their continued use in any substantial quantities.

(6) Forsterite Refractories

The mineral forsterite has the composition $2MgO \cdot SiO_2$, corresponding to 57.3% MgO and 42.7% SiO_2. The melting point of the pure compound is 3470°F.

Forsterite refractories are characterized by their unusually high strength under load at high temperatures. This property, together with their high refractoriness and chemical composition, commended them for study for use as glass-tank regenerator refractories. Although this work dates back only a few years, the results indicate that forsterite refractories may have an extremely wide use in glass-tank construction, where conditions are severe. Forsterite brick are hard-burned and accordingly they are strong after reheating to intermediate or high temperatures. The brick as shipped are strong and in the standard A.S.T.M. load test (25 pounds per square inch) withstand temperatures above 2850°F. Following the successful application of forsterite refractories to checker service, their use has now been successfully extended to complete port walls and crowns.

[1] C. L. Thompson and E. P. Rexford, "Study of an Alumina-Silica Checker Brick from the Regenerator of a Glass Tank," *Jour. Amer. Ceram. Soc.*, **21** [2] 55–59 (1938).

Another important property of the hard-burned forsterite refractories is their immunity to the disintegrating effect of carbon monoxide gas as shown by laboratory tests conducted at the critical temperature for carbon disintegration. As it may be desirable to use these brick in gas checkers, this property may prove to be of real importance. Their successful use in gas checkers, however, has not yet been proved.

(7) Chrome Refractories

For many years, chrome-base high-temperature cements have been used successfully for laying the brick in regenerator walls and for similar applications in which there is no danger of contamination of the glass batch by the chrome. More recently, chrome brick, particularly those of the chemically bonded type, have been tried in regenerator checkers and in adjoining portions of the furnace structure. Results to date are not sufficiently conclusive to indicate whether or not this type of refractory will have particular utility.

III. Checker Design

Checker design has been a matter of much study, and many different arrangements have been developed to provide desirable features. Although it is hardly possible to review these in detail, it may be well to mention the principal characteristics of some of them.

First, however, we might indicate the properties desired in a checker refractory, over and above the primary essential properties of proper chemical composition and adequate physical resistance to meet the prevailing destructive influences. High heat capacity, a function of the unit weight and specific heat, is important. Other desired properties are high thermal conductivity and high emissivity.

With a refractory of a given heat capacity, it is possible by the design of the checker brick to vary considerably the amount of brick material per cubic foot of checkerwork and the proportion of free or open space for the circulation of incoming gas and air and outgoing waste gases. The combination most desired is the maximum weight of brick per cubic foot and a maximum amount of free space to minimize clogging and resistance to flow of the gases. Turbulence of gas flow is of importance in checker efficiency and, as it may be desirable to increase the turbulence, checker design should be considered. Depending upon conditions, it may be desirable to clean the checkerwork at regular intervals with a steam lance or similar equipment. Designs are available which make cleaning convenient. In many instances, the steam may act as a chilling agent to cause the alkaline deposit to separate from the checker brick.

IV. Trend of Development of New Regenerator Refractories

With the marked progress in recent years in the field of regenerator refractories, it is difficult to predict the course of developments in the immediate future. A much denser fire-clay brick of high silica content, however, may possess real merit. Tank blocks have been made for many years from a mix producing blocks of relatively high silica content. Silica brick and the siliceous type of fire-clay brick although of advantage chemically have relatively high porosity. This permits the penetration of the alkaline fluxes with the attendant increased severity of chemical attack. Progress is being made with a siliceous fire-clay refractory of considerably greater density than heretofore produced. With its relatively high silica content, it seems reasonable to expect it to keep free from accumulations as a result of its gradual wearing away. By virtue of its greater density, however, it is logical to expect the rate of wear to be slow.

Some years ago, a brick of the spinel type was investigated in a preliminary manner for its utility in glass-tank regenerators. Although of the general spinel chemical composition, the brick may or may not have had the spinel developed to any great degree. Tests indicated promise, however, and a refractory of this type may prove worthy of further investigation.

A slight modification in the forsterite refractories and modifications of the types of high-alumina brick containing corundum may be promising contributions to future developments.

Harbison-Walker Refractories Company
Pittsburgh, Pennsylvania

CAN THE CERAMIST USE EMULSIONS?*

By Logan Grupelli

Abstract

The theory of emulsions and their properties are considered. An explanation is given for the failure of previous attempts to use emulsions. Recommendations are presented for the successful application of emulsions, and various types of emulsions, such as oils, resins, and waxes, are discussed.

I. Introduction

The chemist dealing with emulsions and the technologist dealing with ceramics have one thing in common. Both rely on a combination of craftsmanship, applied art, and science. This ancient and worthy art has undergone amazing changes in recent years. Its willingness for change and improvement has prompted the writer to offer this paper, in the hope that it might stimulate further interest in the use of emulsions in the modern science of ceramic manufacture.

II. Potential Uses of Emulsions in the Ceramic Industry

Ceramists will be called upon to improve their products and lower costs of production to meet competition, espe-

* Presented at the Forty-Sixth Annual Meeting, The American Ceramic Society, Inc., Pittsburgh, Pa., April 4, 1944 (Materials and Equipment Division). Received March 21, 1944.

cially in the postwar era. This will be especially true in the structural clay products industry which must compete with synthetic building materials.

Perhaps the use of emulsions may help to reduce the number of rejects and increase the efficiency of the extrusion process. Furthermore, in considering new and better binding materials for pressed products, emulsions may be the solution to lower costs. It must be remembered that the plasticity of clays is due to colloidal substances in the form of hydroxides. Perhaps the addition of other colloids may increase the plasticity just as the addition of alkalis reduces the degree of plasticity.

III. Emulsion Fundamentals

(1) Definition and Types

Oil and water will mix, and the chemist calls the mixture an emulsion. Simply stated, an emulsion is a dispersion of two immiscible liquids (such as oil and water) in one another. This dispersion is brought about by a more or less violent agitation of the oil and water with a third ingredient, called an emulsifier, usually in a colloid mill. The mill actually shears the oil into extremely small droplets through the water, and the emulsifier prevents them from uniting again. Some materials, such as oils, are processed so that they are self-dispersible in water. Sulfonated oils, such as cod, castor, and peanut oil, are of this type. These oils, in turn, will act as an emulsifier or "carry" a certain amount of additional untreated oils, such as mineral or vegetable oil.

Although any two immiscible liquids can be made to form emulsions, in practice water is usually one phase, i.e., the continuous phase. The dispersed material, such as wax, resin, solvent, or elastomer, comprises the other, or discontinuous, phase, as its continuity is interrupted. The reverse may be true, however; water may be the discontinuous phase. There are therefore two types of emulsions. When oil is dispersed in fine droplets in water, the emulsion is called the oil-in-water type; when water is the dispersed or discontinuous phase, the emulsion is called the water-in-oil type.

(2) Making a Good Emulsion

As in all physicochemical phenomena, a number of factors enter into the making of a good emulsion, viz., the type of emulsifier, the viscosity of the materials, temperature, phase volume ratio, method of stirring, and time of mixing. Unfortunately, a discussion of all of these factors is beyond the scope of this paper. From a practical standpoint, the following points are sufficient.

(1) The droplets or particles must be as fine as possible. When they are less than three microns in diameter they show a Brownian movement under the microscope, i.e., a continuous motion which is responsible for the stability of some emulsions, such as fine wax emulsions. For practical purposes, a good emulsion may be identified by subjecting a thin film to transmitted light. A blue tinge denotes fine particle size and stability.

(2) The droplets must be prevented from reuniting. Here emulsifiers perform a necessary function. According to Hardy,[1] Langmuir,[2] and Harkins,[3] the emulsifying agent collects at the interface of the two phases of the emulsion. Many emulsifiers are wholly or partly organic in nature and contain polar groups (usually carboxyl, hydroxyl, sulfonic, or amino) and have a great affinity for water. The organic part of the emulsifier theoretically orients itself toward the organic phase, i.e., solvent, wax, or oil, and the polar group toward the water. In this way the emulsifier lowers the interfacial tension and may become absorbed in the interface, thereby preventing the coalescing of oil droplets.

(3) The greater the viscosity of the emulsion, the better the stability. High viscosity, however, can be detrimental in actual practice, and the art of making a stable emulsion with low viscosity may be advantageous.

IV. Practical Considerations

The following practical considerations must be emphasized:

(1) There is no universal emulsifier. An emulsifier need not lower surface tension but must form a protective film around the droplets. Some emulsifiers will form water-in-oil emulsions and some the reverse, depending on the type of materials emulsified and the method of emulsion preparation. Of the many emulsifiers used, the following have a wide scope and are typical of a class.

Sulfonates	Sulfonated oils	Active group $NaSO_3$
	Sulfonated higher alcohols	" " "
Amines	Fatty amine soaps	Active group NH_2
Soaps	Soap (soluble and insoluble)	Active group COONa or COOMg (forms oil-in-water) (forms water-in-oil)
Esters	Polyhydric alcohols, i.e., sorbitan oleate	Active group hydroxyl

(2) Two types of emulsions are possible, water-in-oil and oil-in-water. Each has distinct characteristics, although the essential ingredients may be the same. An oil-in-water emulsion wets like water. When added to clay, it makes it sticky like the addition of water. It will not wet most metals evenly and is easily miscible with water in any quantity. Unless thickened by adding gums, gelatin, or similar materials in proper dilutions, it flows about as easily as water.

A water-in-oil emulsion acts like oil on wet clay. It wets and spreads on certain metals and, in most cases, possesses high viscosity without adding a thickening agent.

This difference is all-important in the use of emulsions as parting or "lubricating" agents in ceramics. The oil should wet the metal of the die but should not make the clay sticky. Emulsions are used for convenience and economy. As solid materials such as waxes and viscous materials such as asphalts cannot be applied conveniently as films to surfaces in their natural physical condition, they are melted or dissolved in a solvent to convert them into liquids. Melting is inconvenient and, when penetration into fine porous surfaces is wanted, is wholly inadequate. This leaves the solvent method, which is not only relatively

[1] W. B. Hardy, *Proc. Roy. Soc.* [London], **86A,** 610–35 (1912); **88A,** 311 (1913).

[2] Irving Langmuir, *Met. Chem. Eng.*, **15,** 468 (1916)and *Jour. Amer. Chem. Soc.*, **39** [9] 1848, 1864 (1917).

[3] W. D. Harkins, F. E. Brown, and E. C. H. Davies, *Jour. Amer. Chem. Soc.*, **39** [3] 354 (1917).

expensive but in many cases constitutes a health and fire hazard. Both of these objections are eliminated by the use of emulsions, as the solvent is water, nontoxic, noninflammable, and the cheapest liquid available.

V. Applications of Emulsions

(1) In Water Processing

Emulsions can be used when water processing is the key to the manufacture of a product, e.g., the manufacture of leather. The fibrous, porous structure of leather permits the easy penetration of emulsions of vegetable or animal oils. The lubricated fibers slide over one another and give the finished leather its well-known flexibility.

(2) Die Greasing

Simcoe and Smith[4] investigated four hundred oils of animal, fish, and vegetable origin and came to the following conclusions:

(1) If an oil, diluted with about twenty parts of kerosene, is used as a die lubricant, applied directly on the die by brushing or mixed in the clay body itself, no harmful effect is observed on the fired pieces. The oil leaves no harmful residue and is completely burned out at ordinary kiln temperatures.

(2) The adhesion between clay and die is broken. When there is a tendency to form a vacuum, the oil, being made of elastic globules, breaks the "suck."

(3) Rich clay mixes require greater dilution of the lubricant or more kerosene; short clay bodies require strong oil mixes or less kerosene.

These findings undoubtedly apply to oil emulsions. The most significant fact, however, and perhaps one of the reasons why in all these years oil emulsions have found little use in ceramics as lubricants, is shown in the following quotation from the article by Simcoe and Smith.[4]

> We even tried water as a cutting agent, forming emulsions with straight oils, and in direct combinations with saponified oil, as 'castor compound' No. 102 on the list. But water will not work, as it combines with the clay, makes it sticky, and is really worse than nothing on the die.
>
> So they decided to use straight oils thinned with kerosene. Unfortunately they tried an oil-in-water emulsion but failed to try the reverse. Subsequent experiments have shown that the water-in-oil type of emulsion does not make the clay sticky but acts much like straight oil. It does not mix with the water of the clay body, but distributes itself in an extremely even and minute film over the surface.
>
> Another practical barrier was encountered in actual field application tests. Ninety-nine times out of one hundred, water-in-oil emulsions possess high viscosity and, in some cases, are actually solid. It is a real accomplishment to make them water thin or thin enough to flow easily, for example, through a pipe $^1/_4$ inch in diameter.
>
> The first test was made on a brick press. The emulsion had to be fluid and flow through the oiler pipes. A thin fluid emulsion having the water-in-oil characteristics was made, which apparently is one of the few water-in-oil emulsions with practically the fluidity of water. There seems to be no reason why such an emulsion cannot be used as a mold lubricant in press work, as a surface mold lubricant, incorporated in the body, or for extruded materials.

As explained previously, emulsions are not limited to oils such as fish, vegetable, or animal oil. Fine stable emulsions can be made of many resins, such as alkyds, polymerized olefins, and coal tar, or binders, such as waxes, pitches, and asphalts. This is the equivalent of making solvent solutions out of them. A solvent used in this respect is really a means of distributing solid or viscous materials evenly over a surface. After application, the solvent evaporates and thus should be considered merely as a temporary carrier for the material to be applied. The residual material in most cases retains its normal, inherent properties.

(3) Power Saver

In the manufacture of brick and tile, the addition of an oil emulsion to the clay body might be the means of saving power. In surface applications for lubricating purposes, emulsions would (1) spread easier over clay surfaces, (2) be absorbed sooner and give quicker drying in the kiln, (3) dry more evenly, and (4) save oil.

(4) Wetting-Out Agents

Although, strictly speaking, emulsions are not wetting-out agents, some emulsifiable materials can act in this capacity. This field should also be of interest to the ceramist. Some wetting-out agents are good foamers. This presents the possibility of aerating some types of ceramics.

Perhaps a good example of a borderline case is a sulfonated oil, which forms an emulsion but can act as a wetting agent. Talc resists wetting by water. The addition of a wetting agent such as sulfonated oil or higher alcohol will not only help wet the talc before incorporation, but may supply surface properties that might be desirable.

(5) Miscellaneous Uses

Emulsions are used for cutting metals, waterproofing, treating textiles, organic or inorganic fibers, paper, waxing floors, and in many other ways. The protective-coating industry uses emulsions of paint, asphalt, and elastomers in greater quantities. These materials should interest the ceramic industry as possible moisture-proofing or even decorative agents.

Emulsions for adding binders to steatite bodies should be definitely considered. Stone[5] states, "If it is an insoluble liquid or solid, add it via an emulsion."

Sulfonated oils, which are really water-emulsifiable oils, are used in soaking decals to facilitate the transfer of the design to the object. They are also used in glazes to improve the coverage of underglaze bands.

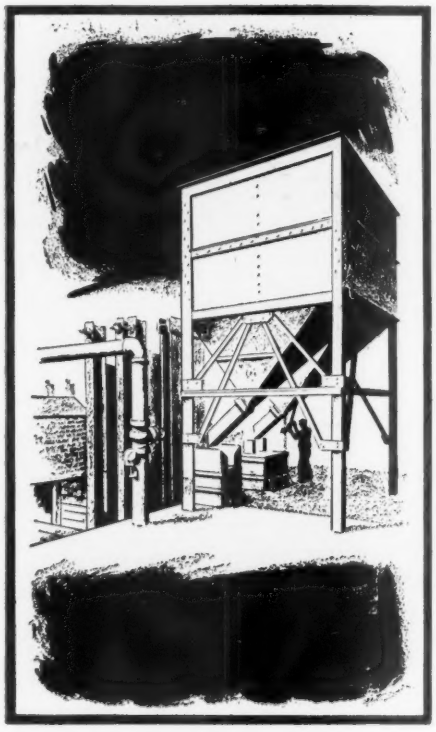
VI. Conclusion

This subject is so new that if this paper has instilled some modicum of interest in this subject of emulsions for use in ceramics, it will have accomplished its purpose.

Market Development Department
National Oil Products Company
Harrison, New Jersey

[4] George Simcoe and A. F. Smith, "Oils, Fats, and Greases for Die Greasing in Manufacture of Dust-Pressed Ware," *Trans. Amer. Ceram. Soc.*, **14**, 558–70 (1912).

[5] Private communication from R. L. Stone, Department of Ceramic Engineering, University of North Carolina, Raleigh, N. C.



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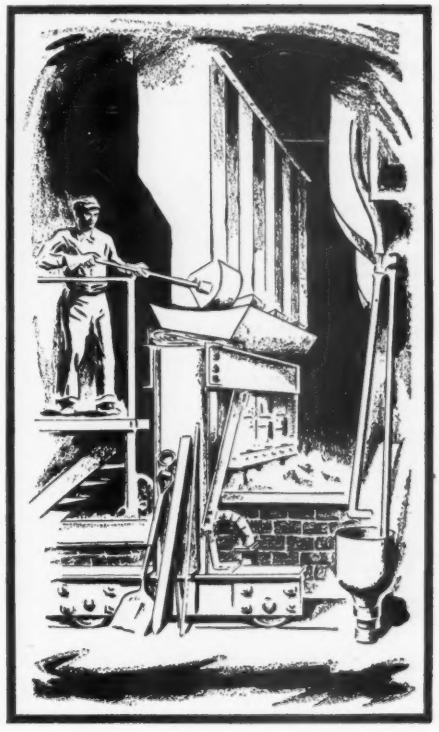

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Hommel, O., Co., Inc.
Vitro Mfg. Co.

Gold Decorations
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Hommel, O., Co., Inc.

Granulators
Lancaster Iron Works, Inc.

Grinding Wheels
Carborundum Co. (*Carborundum and Aloxite*)
Electro Refractories & Alloys Corp.
Norton Co. (*Alundum-Crystolon*)

Gums: *Arabic*—Amber Sorts, Powdered, Grained
Ghatti—Powdered, Granular, Crude
Locust Bean—Powdered
Tragacanth—Ribbon—Flake—Powdered
Innis, Speiden & Co.

Hearths
Carborundum Co. (*Carbofrax* heat treating)
Corhart Refractories Co.
Norton Co. (*Crystolon*)

Hearths (High Aluminous Clay, Electrically Sintered Aluminum Oxide, Silicon Carbide)
Carborundum Co.
Norton Co.

Hydrofluoric Acid
Harshaw Chemical Co.
Hommel, O., Co., Inc.

Iron Chromite
Harshaw Chemical Co.

Iron (Enameling)
American Rolling Mill Co.

Iron Oxide
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Pemco Corp.
Vitro Mfg. Co.

Kaolin
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Maxson, Elwyn L.
United Clay Mines Corp.
Vitro Mfg. Co.

Kilns, China (Decorating)
Drakenfeld, B. F., & Co., Inc.
Ferro Enamel Corp.—Allied Engineering Div.
Frazier-Simplex, Inc.
Harrop Ceramic Service Co.
Hommel, O., Co., Inc.
Swindell-Dressler Corp.

Kilns (Electric, Circular, Tunnel)
Ferro Enamel Corp.—Allied Engineering Div.
Harrop Ceramic Service Co.
Swindell-Dressler Corp.

Kiln Furniture (Silicon Carbide, Semi-Silicon Carbide) (Refractory)
Carborundum Co.
Electro Refractories & Alloys Corp.
Ferro Enamel Corp.—Ceramic Supply Div.

Kryolith (see Cryolite)
Pennsylvania Salt Mfg. Co.

Laboratory Ware
Norton Co.

Lehr Tile (High Aluminous Clay, Electrically Sintered Aluminum Oxide, Silicon Carbide)
Carborundum Co.
Electro Refractories & Alloys Corp.

Lehrs
Frazier-Simplex, Inc.
Swindell-Dressler Corp.

Lehrs (Electric or Fuel Heated)
Frazier-Simplex, Inc.
Swindell-Dressler Corp.

Lehr Loaders
Frazier-Simplex, Inc.

Linings (Furnace Refractory, Block Refractory Plate, Brick, and Tile)
Carborundum Co.
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co.
Vitro Mfg. Co.

Lithium Carbonate
Drakenfeld, B. F., & Co., Inc.
Foote Mineral Co.
Hommel, O., Co., Inc.

Lithium Minerals
Foote Mineral Co.

Magnesia (Fused)
Electro Refractories & Alloys Corp.
Norton Co.

Magnesia (Sintered, Calcined)
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Pemco Corp.

Magnesite
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Vitro Mfg. Co.

Magnesite Calcined
Foote Mineral Co.
Hommel, O., Co., Inc.

Magnesium Carbonate
Drakenfeld, B. F., & Co., Inc.
Ferro Enamel Corp.
Harshaw Chemical Co.
Hommel, O., Co., Inc.

Manganese
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Ferro Enamel Corp.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Vitro Mfg. Co.

Manganese Dioxide
Drakenfeld, B. F., & Co.
Ferro Enamel Corp.
Foote Mineral Co.
Hommel, O., Co., Inc.

Manganese (Oxide)
Corhart Refractories Co.
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Ferro Enamel Corp.
Harshaw Chemical Co.
Hommel, O., Co., Inc.

Masks (Breathing)
Drakenfeld, B. F., & Co., Inc.
Hommel, O., Co., Inc.

Metals (Porcelain Enameling)
American Rolling Mill Co.

Micronized Products
Pemco Corp.

Microscopes (Polarizing)
Bausch & Lomb Optical Co.
Spencer Lens Co.

Microscopes (Stereoscopic)
Bausch & Lomb Optical Co.
Spencer Lens Co.

Minerals
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Vitro Mfg. Co.

Mixers
Clearfield Machine Co.

Mixers (Batch)
Clearfield Machine Co.
Lancaster Iron Works, Inc.

Mixers (Concrete, Paving, Road Paving, Plaster, Asphalt, Truck, Mortar, Bituminous)
Lancaster Iron Works, Inc.

Mixers (Laboratory)
Lancaster Iron Works, Inc.

Mold Sanders
Lancaster Iron Works, Inc.

Muffles (Furnace) (Laboratory)
Carborundum Co. (*Carbofrax*)
Electro Refractories & Alloys Corp.
Frazier-Simplex, Inc.
Norton Co.

Mullers (Batch)
Clearfield Machine Co.
Lancaster Iron Works, Inc.

Muriatic Acid
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.

Needle Antimony
Foote Mineral Co.
Harshaw Chemical Co.
Hommel, O., Co., Inc.

Nepheline Syenite
Great Lakes Foundry Sand Co.

Nickel Salts
Drakenfeld, B. F., & Co., Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.

Nitrates (Cobalt, Sodium)
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Vitro Mfg. Co.

Nitre
Harshaw Chemical Co.
Hommel, O., Co., Inc.

Norbide (Norton Boron Carbide)
Norton Co.

Olivine
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.

Opacifiers
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Metal & Thermit Corp.
Pemco Corp.
Pennsylvania Salt Mfg. Co.
Titanium Alloy & Mfg. Co.
Vitro Mfg. Co.

Overglaze Colors
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Ferro Enamel Corp.
Hommel, O., Co., Inc.

Oxides
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Ferro Enamel Corp.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Metal & Thermit Corp.
Pemco Corp.
Titanium Alloy & Mfg. Co.
Vitro Mfg. Co.

Palladium Decorations
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Hommel, O., Co., Inc.

Pans—Wet and Dry
Clearfield Machine Co.

Pins
Hommel, O., Co., Inc.
Industrial Ceramic Products, Inc.
Potters Supply Co.

Placing Sand
Great Lakes Foundry Sand Co.
United Clay Mines Corp.

Platinum Decorations
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Hommel, O., Co., Inc.

Polariscopes
Bausch & Lomb Optical Co.
Frazier-Simplex, Inc.

Porcelain Enameling Service (Practical)
American Rolling Mill Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Ferro Enamel Corp.
Hommel, O., Co., Inc.
Pemco Corp.
Titanium Alloy & Mfg. Co.
Vitro Mfg. Co.

Porcelain Enamels
Ferro Enamel Corp.
Hommel, O., Co., Inc.
Pemco Corp.
Titanium Alloy & Mfg. Co.
Vitro Mfg. Co.

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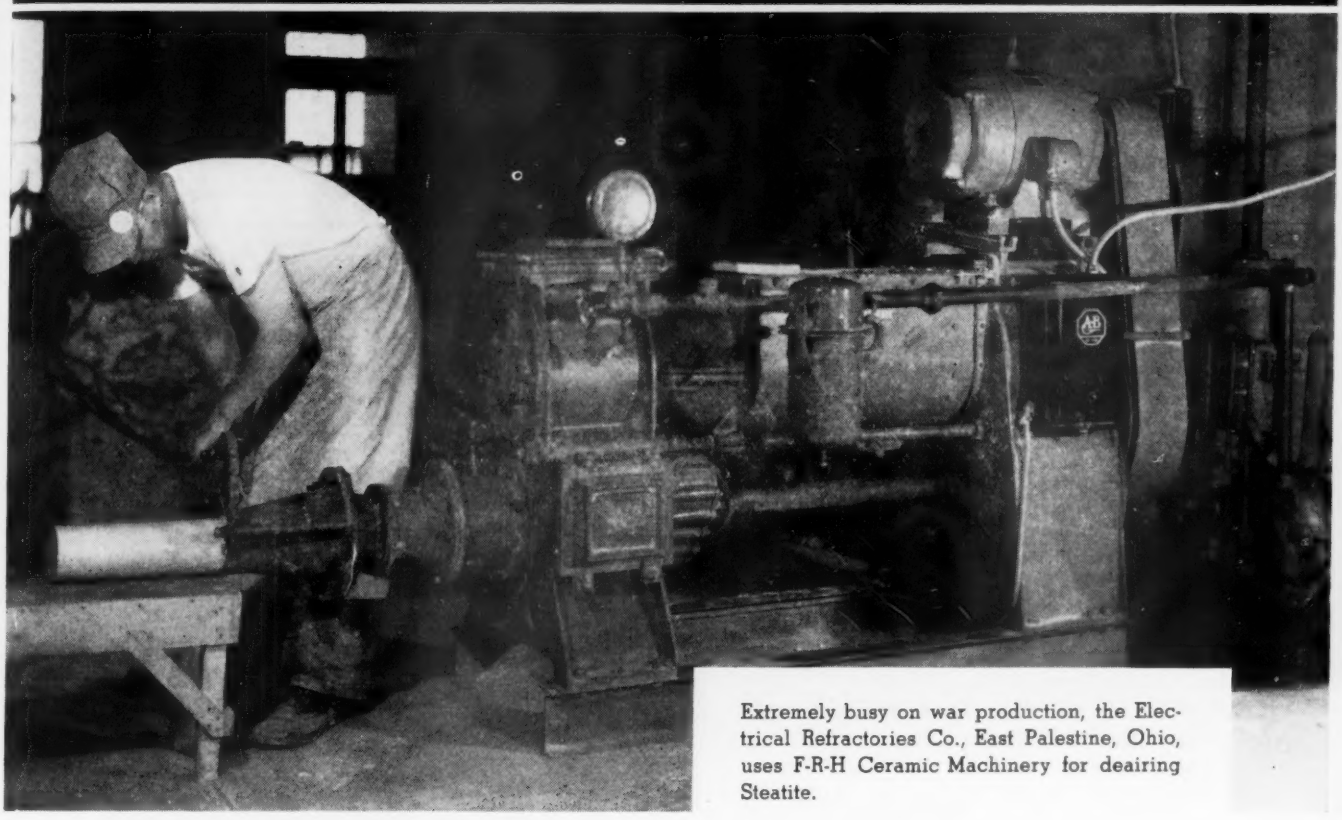

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PLYMOUTH Industrial Locomotives

F·R·H
Clay Working Machinery

SILVER KING Industrial Tractors

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Harshaw Chemical Co.
Hommel, O., Co.,Inc.
Innis, Speiden & Co.
Vitro Mfg. Co.

Potassium Hydroxide
Innis, Speiden & Co.

Producer Glass Plants
Frazier-Simplex, Inc.

Pug Mills
Lancaster Iron Works, Inc.

Pyrites (Natural Iron Sulphide)
Foote Mineral Co.
Hommel, O., Co., Inc.

Pyrometer Tubes
Carborundum Co.
Leeds & Northrup Co.
Montgomery Porcelain Products Co.

Pyrometer Tubes (Refractory and Hard Porcelain)
Electro Refractories & Alloys Corp.
McDanel Refractory Porcelain Co.
Montgomery Porcelain Products Co.
Norton Co.

Pyrometers (Optical, Radiation, Surface, Immersion, Needle)
Leeds & Northrup Co.

Pyrometric Cones
Edward Orton, Jr., Ceramic Foundation

Raw Material Handling Equipment
Frazier-Simplex, Inc.
Lancaster Iron Works, Inc.

Recorders, CO_2
Leeds & Northrup Co.

Recorders, Draft
Leeds & Northrup Co.

Recorders, Tank Pressure
Leeds & Northrup Co.

Refractometers
Bausch & Lomb Optical Co.
Electro Refractories & Alloys Corp.
Spencer Lens Co.

Refractories
Carborundum Co.
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co.

Refractory Materials
Carborundum Co.
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co.
Titanium Alloy & Mfg. Co.

Respirators
Drakenfeld, B. F., & Co., Inc.
Hommel, O., Co., Inc.

Rutile
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Metal & Thermit Corp.
Orefraction, Inc.
Vitro Mfg. Co.

Saggers
Carborundum Co.
Electro Refractories & Alloys Corp.
Ferro Enamel Corp.—Ceramic Supply Div.
Norton Co.
Potters Supply Co.

Salt Cake
American Potash & Chemical Corp.
Drakenfeld, B. F., & Co., Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.

Sandblast Sand
Great Lakes Foundry Sand Co.

Sand Grinders and Sifters
Lancaster Iron Works, Inc.

Selenite of Sodium
Drakenfeld, B. F., & Co., Inc.
Hommel, O., Co., Inc.
Vitro Mfg. Co.

Selenium
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Vitro Mfg. Co.

Sheets (Enameling Iron)
American Rolling Mill Co.

Silica (Fused)
Electro Refractories & Alloys Corp.
Foote Mineral Co.
Hommel, O., Co., Inc.

Silicate of Soda
Harshaw Chemical Co.
Hommel, O., Co., Inc.

Silicon Carbide
Carborundum Co.
Electro Refractories & Alloys Corp.
Norton Co.

Silicon Carbide Firesand
Carborundum Co.

Sillimanite Refractories
Electro Refractories & Alloys Corp.

Slabs (Furnace)
Carborundum Co.
Electro Refractories & Alloys Corp.
Norton Co.

Soda Ash
American Potash & Chemical Corp.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.
Vitro Mfg. Co.

Sodium Antimonate
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., &[i]Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Metal & Thermit Corp.
Vitro Mfg. Co.

Sodium Fluoride
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Vitro Mfg. Co.

Sodium Metasilicate
Harshaw Chemical Co.
Innis, Speiden & Co.

Sodium Nitrite
Harshaw Chemical Co.
Hommel, O., Co., Inc.

Sodium Orthosilicate
Innis, Speiden & Co.

Sodium Silica Fluoride
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Innis, Speiden & Co.

Sodium Uranate
Drakenfeld, B. F., & Co., Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.

Soot Blowers
Frazier-Simplex, Inc.

Special Machines
Frazier-Simplex, Inc.

Spar
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Maxson, Elwyn L.
Vitro Mfg. Co.

Spray Booths
Hommel, O., Co., Inc.

Spraying Equipment
Hommel, O., Co., Inc.

Spurs
Potters Supply Co.

Stacks
Lancaster Iron Works, Inc.

Steel Plate Construction
Lancaster Iron Works, Inc.

Stilts
Hommel, O., Co., Inc.
Industrial Ceramic Products, Inc.
Potters Supply Co.

Sulfur
Hommel, O., Co., Inc.
Stauffer Chemical Co.

Sulfuric Acid
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.
Stauffer Chemical Co.

Talcs
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Innis, Speiden & Co.
International Pulp Company

Tanks
Frazier-Simplex, Inc.

Tank Blocks
Corhart Refractories Co.

Tanks (Pickle)
Hommel, O., Co., Inc.

Tanks for Raw Material Steel or Concrete
Lancaster Iron Works, Inc.

Tile (Floor)
Norton Co.

Tile (Muffle)
Carborundum Co.
Electro Refractories & Alloys Corp.
Norton Co.

Tile (Refractory)
Carborundum Co., (*Carbofrax*)
Electro Refractories & Alloys Corp.
Norton Co.

Tin Oxide
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Hommel, O., Co., Inc.
Metal & Thermit Corp.
Vitro Mfg. Co.

Titanium
Drakenfeld, B. F., & Co., Inc.
Foote Mineral Co.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Titanium Alloy & Mfg. Co.
Vitro Mfg. Co.

Titanium Oxide
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Metal & Thermit Corp.
Titanium Alloy Mfg. Co.
Vitro Mfg. Co.

Trisodium Phosphate
Harshaw Chemical Co.
Hommel, O., Co., Inc.

Trucks
Lancaster Iron Works, Inc.

Tubes (Insulating)
Carborundum Co.
McDanel Refractory Porcelain Co.
Norton Co.

Tubes (Pyrometer)
Carborundum Co.
Electro Refractories & Alloys Corp.
Leeds & Northrup Co.
McDanel Refractory Porcelain Co.
Montgomery Porcelain Products Co.
Norton Co.

Uranium Oxide
Drakenfeld, B. F., & Co., Inc.
Ferro Enamel Corp.
Harshaw Chemical Co.
Hommel, O., Co., Inc.

Uranium Oxide (Yellow-Orange-Black)
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Ferro Enamel Corp.
Hommel, O., Co., Inc.
Vitro Mfg. Co.

Water Softening Plants
Frazier-Simplex, Inc.

Waxes (Beeswax, Carnauba, Refined yellow Beeswax)
Innis, Speiden & Co.

Wet Enamel
Ferro Enamel Corp.
Hommel, O., Co., Inc.
Pemco Corp.
Titanium Alloy & Mfg. Co.
Vitro Mfg. Co.

Whiting
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Vitro Mfg. Co.

Winding Drums
Lancaster Iron Works, Inc.

Zinc Oxide
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Vitro Mfg. Co.

Zircon
Foote Mineral Co.
Hommel, O., Co., Inc.
Metal & Thermit Co.

Zirconia
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Metal & Thermit Corp.
Titanium Alloy & Mfg. Co.
Vitro Mfg. Co.

Zirconium Oxide
Foote Mineral Co.
Hommel, O., Co., Inc.
Titanium Alloy Mfg. Co.

Zirconium Silicate and Ultrox
Hommel, O., Co., Inc.
Metal & Thermit Corp.

Zirkite (Natural ZrO_2)
Foote Mineral Co.
Hommel, O., Co., Inc.

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COMPLETE MEMBERSHIP ROSTER

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WILL BE PUBLISHED IN THE OCTOBER BULLETIN

This ROSTER will be the "Who's Who" of Ceramic Technology; therefore, the name of every ceramist should be listed.

Advertising will be especially effective in the October Bulletin because the circulation will be greatly increased and because this Roster will be referred to constantly.

Please reserve advertising space now.

Dead Line!

is September 21—for advertising copy to be used in the October 1944 Membership Roster of The American Ceramic Society.

The Membership Roster is an up-to-date list of all the paid members of The Society.

Number of Insertions

	1 month	*3 months*	*6 months*	*12 months*
Full page	$66.00	$60.00	$52.00	$44.00
Half page	36.00	33.00	30.00	26.00
Quarter page	20.00	18.00	16.50	15.00
Eighth page	10.75	9.90	9.00	8.25

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Lehrs and Enameling Furnaces, Electric and Gas Fired

Full Details Furnished on Request

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Transactions of The American Ceramic Society

Volumes 2, 6, 9, 10, 12, 15, 17, 19

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  English and American
- **CERAMIC COLORS**
  Blythe Colour Works, Ltd.
- **SLABS...SETTERS...SAGGERS**
  New Castle Refractories Co.
- **STANDARD PYROMETRIC CONES**
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  Great Lakes Foundry Sand Co.

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Offices & Storeroom **1526 Canada Blvd.,** **Glendale, Calif.**

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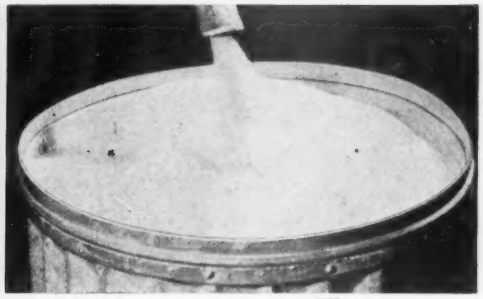

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A bimonthly Journal containing the original papers communicated to the Society together with abstracts of other papers covering the whole field of glass technology.

Membership of the Society is open to all persons, or associations of persons, interested in glass.

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Society of Glass Technology,
The University,
"Elmfield," Northumberland Road,
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"Quite pleased with the way Zircopax glaze is performing."

"All the opacifier we use is Zircopax and it does a good job."

"...much encouraged with results on these glazes (made with TAM Zirconium Opacifiers) and will do more work with them."

"Getting good results with 8½% Zircopax, two fire, cone 4 to 5 glaze."

"This glaze (made with Zirconium Opacifiers) is between 1¾¢ and 2¢ a pound cheaper than old tin glaze."

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ALLOY MANUFACTURING COMPANY

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ZIRCONIUM AND TITANIUM
PRODUCTS
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Representatives for Europe . . UNION OXIDE & CHEMICAL CO., Ltd., Plantation House, Fenchurch St., London, E. C., England

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Select the Brand which has back of it years of *successful use* by experienced Ceramists

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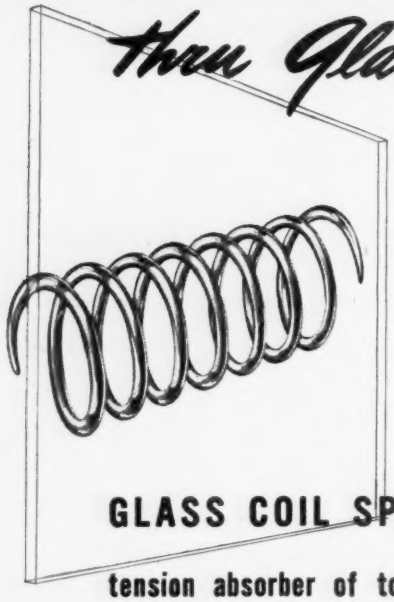

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Columbus, Ohio
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October 27, 1944

CERAMIC ASSOCIATION OF NEW YORK

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